

SUPPLEMENT

TO

THE MEDICAL JOURNAL OF AUSTRALIA

SYDNEY, SATURDAY, JUNE 7, 1924.

Section VII.—Otolaryngology.

(Continued.)

(Discussion following Dr. R. S. Godsall's paper.)

SIR WILLIAM MACEWEN said that he agreed with Dr. Godsall that the frontal sinus should be allowed to granulate after operation in just the same manner as was commonly adopted for the mastoid antrum. Care should be taken to deal with the ethmoids and sphenoids if necessary; otherwise there was a danger that polypi from the sphenoid would sprout into the frontal sinus.

MR. W. KENT HUGHES doubted the wisdom of removing so much of the superior maxilla as had been advocated by Dr. Godsall. He endeavoured to leave the nasofrontal duct intact and he did not preserve any partitions in the cavity of the sinus.

DR. J. STODDART BARR commended the operation as giving good access to the ethmoid, but was of opinion that in a sinus of a certain configuration it might not meet all requirements. For instance, it would be very difficult to clear out those sinuses which extended far upwards and outwards and in which septa which should be broken down were out of reach.

DRS. S. A. EWING and T. S. KIRKLAND also spoke.

THE MARTYRDOM OF THE NOSE.

By R. H. PULLEINE, M.B., M.S. (Sydney),
Adelaide.

THE object of this paper is not to enter into the history of nasal operative surgery which during the evolution of the art suffered more than most branches from the absence of what to-day are our best aids, efficient illuminating devices, adrenalin and reliable local anaesthesia.

Up to the time that surgeons lacked these they were justified in doing the best they could and they undoubtedly did it.

What we have to consider is whether nasal surgery to-day is up to the high level it ought to be and whether we are not still from ignorance or carelessness harbouring some ancient procedures which can no longer merit inclusion in the technique of our art.

The canons of the surgery of the nose may be stated as follows:

- (1). The efficient performance of the surgical procedure with the minimum of disturbance of function.
- (2). The avoidance of removal of physiological structures, however insignificant.
- (3). The efficient carrying out to its logical conclusion of any surgical procedure entered upon.

(4). The avoidance of any source or of any method of procedure likely to cause local or distant infection from retention of packing, dead tissue, or any other cause.

(5). Due consideration of cosmetic results in the terminal results of the operation.

We will now consider each of these *seriatim*.

The respiratory function of the nose is carried out by its mucous membrane. This is very thick in the region of the turbinates, four millimetres when empty, seven millimetres in congested state, according to Henle and others, while it thins down to less than half a millimetre in the sinuses.

Throughout this membrane is covered with cylindrical ciliated epithelium, the cilia of which continuously work towards the choanae. Opening on to the surface of this membrane are two sorts of glands, the so-called goblet cells and the *glandulae nasales* which, according to Sappey, number one hundred and fifty to the square centimetre.

The secretions which these cells produce, are swept without ceasing from the introitus to the choana carrying in on its surface all the solid impurities of the air we breathe. If we visualize this, we see how important it is to maintain our ciliated epithelium and glands at the high tide of efficiency.

Over a part of the intra-nasal walls, especially over the turbinates, the mucous membrane overlies an exceedingly thick vascular erectile membrane, a sort of *corpus cavernosum* in which the vessels are arranged in two definite layers, an outer fine network overlying a coarser one. The extraordinary amount of blood this tissue can hold is familiar to those who use adrenalin as an adjunct to diagnosis and treatment.

The glandular secretion of the nose is exceedingly rich in protein and when treated with certain acids, such as the chlor-acetic group, forms a protein coagulum.

The superficial layer of vessels of the turbinates when emptied and covered with this coagulum, as when the inferior turbinate is treated with trichlor-acetic acid, fill very imperfectly and the erectile function is much reduced. The effect of this acid is not destructive to the ciliated epithelium nor does it apparently hinder its ciliary activity as judged from the functional activity test.

Taking these facts into consideration, have we any right to use the actual cautery in the nose and yet its use is recommended in text-books for reducing the tumidity of the nasal mucosa by surface burning or deep parallel cautery lines and instrument sellers in this city and others say that the nasal cautery point is frequently ordered.

Now what is the effect of using the cautery? The tissue has to be burnt. Burnt tissue is dead tissue and has to be removed. The removal of dead tissue causes local and general bodily reaction. Sloughs must be thrown off, the lymphatics have to work overtime to get rid of their share of the dead tissue and the glands in the drainage system of the nose show their discomfort by tenderness and swelling. Afterwards comes the interference with function; powder tests show dead areas in the ciliary stream, sometimes large, often insignificant in size.

And then after all is the method efficient? This is open to doubt. Its efficiency is at any rate not comparable to that of general vascular reduction by a non-mineral coagulant which forming a protein coagulum seals the area against infection, does not injure the ciliary cells and is thrown off without any lymphatic disturbance.

Therefore it is the method we should use and the cautery should receive its quietus. The use of escharotics, chromic and mineral acids and silver nitrate, only need to be mentioned amongst the inexcusable errors of the past.

The Avoidance of the Removal of Physiological Structures.

Up to twenty years ago inferior turbinectomy was taught as a surgical procedure in nasal obstruction. Since the introduction of the submucous resection early in the century this has no justification in practice and yet I regret to say this fearful rhinological wild fowl, savouring more of an assault than an operation is still with us. Its names spells hæmorrhage, anæmia, sepsis and *otitis media*; from the necessary prolonged packing, damaged health and sometimes *exitus lethalis*. The free side, which does not need it, is made too free; the narrow side seldom benefits owing to want of room for the manipulation and septum perforations and adhesions occur frequently.

What has happened? The most valuable modulating organ in our nasal passages has been removed and in our climate the inevitable result is that sooner or later the individual who at first feels free in his breathing, comes for advice for the increasing dryness of the nasal passages and especially the posterior wall of the pharynx.

If we exclude as an extreme rarity a real hypertrophied polypoid fringe of the inferior turbinate (removable with one sweep of the shears without touching the bone), deformity of the outer wall does not exist for us and interference with this, when the central partition is at fault, has no surgical justification. Lambert Lack says that it is worse than useless to restore nasal breathing by removing the structure upon which the value of nasal breathing mainly depends.

Compare a well carried out resection with the incision in the muco-cutaneous margin—no interference with function, not a cilium injured, no hæmorrhage or sepsis, no packing except two rubber tubes, no pain, no stitches, no anything, all healed in forty-eight hours.

On this evidence turbinectomy ought to receive its quietus.

Mosher has given us a lesson in conservatism when he removes the anterior ethmoidal cells under cover of the displaced middle turbinate.

It is gradually forcing itself on us that the middle turbinate has definite functions and removal of any part of it except under exceptional and definite indication is not justifiable.

There are in the first place few conchæ that we cannot make room for by a skilful resection of the upper part of the septum without necessarily interfering with the lower part which may not be causing any obstruction. Under these conditions the roof of the nose is ventilated and the incarcerated middle turbinate ceases to be incarcerated.

Thick turbinates can be flattened out by pressure with Killian's flat forceps and if there is a posterior ethmoid cell developed in the concha, it can be opened sagittally and pressure applied will effect evacuation and flattening at once.

A few words on the posterior end! In my early days I used to be fond of snaring these, but I found on using adrenalin that the apparently large moriform mass used to shrink until the snare refused to engage. Since then under a good light I have painted these with 99% trichloroacetic acid after maximum shrinking with adrenalin, reserving snaring for the real hypertropies that are rare and I have every reason to be satisfied with the result.

One of the ways in which the nose is surgically sinned against, is by means of the incomplete operation. This is often the corollary of the incomplete anamnesis and the incomplete examination. Sometimes, however, it is due to defective technique or insufficient preparation for the practice of rhinology. These incomplete operations are serious enough from the point of view of the patient when they can be done again and finished, but it is different when we come face to face with an unremoved posterior septal obstruction keeping up irritation and asthma and we know that between us and it there is a no man's land of mucosa and muco-perichondrium *sine cartilago septi anterior* that will doubtfully stand the strain of reconsidering the case.

A few words on efficient nasal packing as a means of avoiding discomfort may be included here. The things to be aimed at are to provide unhindered breathing and ventilation and prevent stasis. After resection and most nasal operations a pencil thick rubber tube in the inferior meatus will provide this with only just enough oiled gauze above it to prevent it shifting. Primary suturing of the muco-cutaneous incision, so surgical elsewhere, is not good practice here as it prevents the intra-septal exudate from escaping and leads to retention and often to delayed restoration of function. I find it better to close the wound if necessary twenty-four hours after operation when the packing is removed. As a rule it has already united faultlessly.

SUPPURATIVE DISEASE OF THE MASTOID ANTRUM, OTO-ANTRITIS.

Difficulties of Diagnosis and the Danger of Non-Recognition.

By S. A. EWING, M.R.C.S. (Eng.), D.P.H. (Cantab.),
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THE association of suppurative disease of the mastoid antrum with evidence of suppurative or inflammatory conditions in the tympanic cavity is so generally the rule that when there is no evidence of these being present,

there is a risk of overlooking a grave source of danger. My attention was first drawn to this problem when acting as clinical assistant at the Victorian Eye and Ear Hospital in 1902.

One of the patients whom I examined, had a normal tympanum, normal hearing, with an evident mastoiditis. In such a case there was no difficulty in the diagnosis or appropriate treatment. A still graver problem is where the disease is confined to the antrum and extends neither to the mastoid process nor to the tympanic cavity. This is the type of case to which I particularly wish to draw your attention. Here the suppurative disease is limited to the antrum. There is no evidence of disease in the tympanum or mastoid process.

I drew attention to such type of cases in a communication on intra-cranial complications in suppurative otitis at the Australasian Medical Congress held at Auckland in 1914.

We may divide the type of mastoid process into three classes, the pneumatic, the diploic and the sclerotic.

The second and third types, the diploic and the sclerotic, are the ones which naturally favour the class of affection to which this paper refers.

Reiterating in a paper, "The Difficulties of Diagnosis of Intracranial Extension in Suppurative Otitis," read on March 3, 1915, before a meeting of the Victorian Branch of the British Medical Association, I stated that the absence of a perforation or pus in the middle ear does not exclude suppuration in the antrum or cerebral complications.

This conclusion arose from the consideration of the death of a child from a temporo-sphenoidal abscess, without history of suppurative otitis. I have had four cases of suppuration of the antrum in which the tympanum and mastoid were uninvolved, one due to the *Streptococcus haemolyticus* in which my previous experience led me to a decision. Of the other three patients two developed meningitis and the third a cerebral and cerebellar abscess.

The history of the last of these cases is so unusual that a brief résumé may be of interest. This shows the gravity of this type of case and the necessity of recognizing the early symptoms.

Mrs. E. G., *aetatis* 43 years, was seen by Dr. Blaubaum on July 7, 1923. On examination he found a small tympanic perforation and some small granulations in the right ear. There was some tenderness without swelling five or six centimetres behind the meatus. Four days later a small swelling developed five centimetres posterior to the meatus. On my return to practice I found that there was some muco-purulent secretion in the ear and the swelling was beginning to fluctuate. On drying the ear and pressing over the swelling, thick creamy pus poured through the perforation in the drum. There was no mastoid tenderness or swelling. She gave a history of a severe cold in May, 1922. In November very severe pains developed in the temporal region. Referred by her physician to the Eye and Ear Hospital she was informed that the ear was not affected and that she should attend a general hospital.

After being under one of the physicians at St. Vincent's Hospital for a fortnight, she was referred to the special department where treatment was carried out for

three weeks. At the end of this period the patient was awakened early one morning by a loud report in the ear and a discharge came away. The pain was relieved to a slight extent, but paroxysms of severe pain came on in the right temporal region with a tendency to nausea. Occasional rigors occurred lasting for hours and if she was approached suddenly, a loss of power and a numb feeling developed in the left upper extremity.

Operation was performed on July 19, 1922. The swelling behind the mastoid had extended over the mastoid with considerable brawny infiltration. The mastoid cells were not involved, pus only appearing on opening the antrum. Large quantities of pus poured into the antrum through a fistula in the bone internal to the lateral sinus. This communicated with an opening in the occipital bone some five centimetres posterior to the meatus. The *dura mater* in the occipital region showed numerous pearly granulations, but was firmly attached to the bone. A curved probe was passed behind the lateral sinus through the cerebellum and out through the opening in the occipital bone.

The *dura mater* above the roof of the antrum was covered with greyish pearly granulations; when the temporo-sphenoidal lobe was explored, another large abscess was found.

Large rubber drainage tubes were inserted into the cerebellum and temporo-sphenoidal lobe and rubber tissue in the opening behind the meatus. Recovery was rapid and uneventful.

The tympanum is now healed and the hearing good. Rinne's test gave a + response.

The pus yielded a pure culture of *Staphylococcus albus*.

The rotation tests and caloric tests are of interest.

With rotation to the right there was past pointing on the right side. The right touched, while the left was three inches to the right. Nystagmus towards the right side was produced and continued for fifteen seconds. With rotation to the left there was past pointing on the right side three inches to the left and on the left side four inches to the left. Nystagmus towards the left side was produced and continued for ten seconds.

To the caloric test with water at 20° C. (68° F.) there was no response of either the left or the right vertical canals. This result indicated increased intracranial pressure. When applied to the right ear the right hand touched, while there was past pointing five inches to the right with the left hand. When the test was applied to the left ear the right hand showed past pointing three inches to the left and the left also showed past pointing three inches to the left. There was good nystagmus.

This case illustrates clearly the fact that there was grave disease in the mastoid antrum for some considerable time with cerebral complications before any indication of middle ear infection was found, while the mastoid proper itself was not involved at all. It seems rather strange that a case was reported quite recently in THE MEDICAL JOURNAL OF AUSTRALIA by Dr. T. L. Anderson, of Perth, in which there was mastoiditis with a sub-dural abscess which perforated the occipital bone in the same way and in which a successful operation was performed a fortnight after the operation I am now discussing. Dr. Anderson describes the perforation in the bone as resulting from a sub-dural abscess; the presence of a fistula behind the lateral sinus rather suggests cerebellar abscess.

The history of one of the patients who died of meningitis is also of interest. A patient admitted to the Alfred Hospital for severe pains in the temporal region extending towards the occiput, was examined by me. There was no tenderness or pain in the mastoid region and the tympanic membrane was perfectly normal. I decided that further observation was advisable in the absence of any aural symptoms. I was called to the hospital two days afterwards, the patient having a temperature of 39.5° C. (103.2° F.) and symptoms of meningeal involvement. When the mastoid was opened, the antrum showed granulations on the tegmen. On exposing the *dura mater*, both it and the *pia mater* were found to be extensively involved.

In the other case of meningitis the chief symptom was pain in the temporal region. The patient whose history I have reported above was the more recent affected, and she can be seen on Friday afternoon at the Eye and Ear Hospital.

In these cases severe pain in the temporal and occipital region has been the most evident symptom. The persistence of such pain, usually severe, in the absence of other causes indicates the advisability of not overlooking disease in the antrum. I have noticed the same distribution of pain in the temporal and occipital regions in patients on whom the radical mastoid operation has been performed, when inflammatory changes take place in the roof of the antral cavity secondary to the accumulation of epithelial debris. These pains rapidly yield to treatment of the infected area.

These patients may have a leucocytosis and in the use of X-rays, by comparing one side with the other, we have an important help in arriving at a correct diagnosis.

MASTOID DRAINAGE IN EARLY CHRONIC SUPPURATIVE OTITIS MEDIA.

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THE programme of this Section of Congress as first submitted provided for the discussion of the surgery of the mastoid antrum. This prompted me to direct attention to the doubts and difficulties encountered in dealing with a type of case constantly before aural surgeons, that is the problem of what to do and when to do it in cases merging from the acute to chronic state of suppurative *otitis media*. I hope that this phase of aural surgery will receive the attention it deserves and will be fully discussed by members. It was more in the hope of promoting this discussion and not that I have much new doctrine to preach that I wrote this short paper endeavouring to place before you some aspects of this problem that present themselves to me.

Excepting the rare cases of tuberculosis of temporal bone purulent *otitis* begins with an acute infection of the lining membrane of the middle ear extending from an inflamed Eustachian tube which itself swells and blocks the natural drainage outlet of the middle ear. The middle ear fills with purulent fluid which finds a vent through

the tympanic membrane. The subsequent course of events cannot be predicted. Usually the discharge lessens and the Eustachian tube becomes patent, the perforation of tympanic membrane closes and hearing is completely restored. On the other hand the condition may become chronic and end in disaster.

Is it possible by better management of cases of suppurative *otitis* in its early stages to lessen the incidence of chronic suppurative *otitis* with its attendant dangers and disabilities? This question I think involves two problems: (i.) How to determine at an early stage which cases are likely to become chronic; (ii.) how to improve our method of treatment to deal more effectually with these incipient chronic cases.

It may assist you in following my rambling statements if I state here that I think we can solve problem (i.) with limitations and for the solution of problem (ii.) I shall suggest the more frequent employment of the Schwartz's operation in early chronic cases of a certain type.

Kerrison in his excellent book on "Diseases of the Ear" states that from the standpoint of practical otology, it is best to consider acute middle ear inflammation under two headings: (i.) acute catarrhal *otitis media* by which term I shall designate any acute inflammation, purulent or non-purulent, confined to the atrium and (ii.) acute purulent *otitis media* or an acute inflammation involving both the atrium and the tympanic vault.

These two conditions undoubtedly represent respectively the simpler and the more serious forms of acute tympanic infection met with in actual practice. I think this does make a practical division of cases from the point of view of treatment in that the former always clear up naturally and requires no interference. It is with the latter division only that I am dealing.

The acutely suppurating middle ear may be regarded as an abscess cavity draining through a perforation in the drum membrane. One would naturally expect that the longer and lower in situation the perforation the better is the prospect for rapid healing but cases become chronic in spite of a favourable opening in tympanic membrane. The prospect must be improved when the Eustachian tube is also providing a drainage outlet but a well open tube in addition to good "perforation" drainage will not insure recovery.

In addition to perforated drum membrane and the Eustachian tube there is a potential drainage passage provided via the mastoid antrum and cells. We have all seen patients in whom *otitis media* has extended naturally and found an outlet in the rupture of an abscess over the mastoid bone. It is on this potential outlet from the middle ear that I wish particularly to dwell. I remember the late Hunter Todd at his London hospital clinic referring to acute mastoiditis as a blessing in disguise and meaning that this extension of *otitis media* called for the surgical opening of the antrum with resulting benefit to the middle ear. I think that the general experience of aural surgeons is that cases of acute *otitis* that come to operation on account of mastoiditis, do remarkably well and that the middle ear condition promptly clears up, the perforation closes and hearing is restored. Evidence that this favourable termination is not

merely an impression but an established fact is supplied in reports by Drs. Hewats and Boyd on 388 cases of acute *otitis media* with mastoiditis operated on by Dr. Logan Turner and Dr. J. S. Fraser in Edinburgh. In this large series there was only 3.2% definitely acute uncomplicated cases in which the Schwartz's operation failed to effect a cure. In acute *otitis* developing the classical signs of mastoid extension our course is clear and the appropriate treatment of Schwartz's operation admits of no controversy. It is in the management of uncomplicated acute *otitis media* that we are on more or less uncertain ground from the beginning. Experience teaches us that Nature will effect a cure, assisted no doubt to some extent by our time honoured drops, in the majority of cases; we also know that spontaneous recovery will frequently not take place, but the condition will continue indefinitely with constant or recurring otorrhea and permanently defective hearing. In other cases though the discharge may eventually cease and the hearing improve to "no incapacity," the perforation in the drum membrane remains. This condition of perforated drum membrane in a quiescent ear leaves a door open to subsequent fresh infection from the meatus. We have all seen *otitis* begin again after such an ear has been syringed for cerumen or the head immersed in water.

This then is the problem how to determine at an early stage the cases in which Nature will fail to effect complete restoration of the tympanum. If we can find a solution to this, we shall be on more certain ground in proceeding by art to correct Nature's failure.

Pneumatic and Non-Pneumatic Type of Bone.

The anatomical researches of Arthur Cheatle have demonstrated that mastoid processes may be either cellular (pneumatic) or acellular (non-pneumatic), the former comprised 80% of bones examined and the latter 20%. Logan Turner skiagraphically examined one thousand crania and demonstrated that the type of bone can be decided by radiogram, at the same time confirming Cheatle's finding of 80% pneumatic or cellular in Europeans. Cheatle also pointed out the difference to be expected in the course of infection in the cellular and in the acellular temporal bone. In the highly cellular bone, as a general rule, acute *otitis* clears up promptly or suppuration extends to the mastoid cells causing an acute mastoiditis, which, as we know, with Schwartz's operation clears up with happy results for the middle ear. On the other hand chronic suppuration will probably result in the acellular type of bone. It has been our common experience to encounter a high percentage of acellular bones in performing the radical mastoid operation. The explanation formerly offered for this was that the bone had become sclerosed and mastoid cells obliterated by long continued inflammation but, I think, no one now disputes Cheatle's contention that the sclerosis is merely an anatomical type of the bone predisposing to chronic suppuration in the middle ear and antrum. Why the transition from acute to chronic suppuration is probable in the acellular bone is not clear. A possible explanation that occurs to me, is that the cellular bone is more vascular and on this account better able to overcome infection. If we accept this axiom of Cheatle, it follows that we should in every case of acute *otitis* that is not clearing

up promptly, determine by a radiogram the type of mastoid bone with which we have to deal and if it is of the acellular type, then we have a distinct warning to fear chronicity. If the treatment of such a case be limited to metal drops and dressings, there is a big risk of failure and if continued too long, a radical mastoid operation with its limited virtues and decided evils may be the only alternative. It is in these cases of *otitis media* with acellular mastoids that early drainage of the antrum by the Schwartz's operation should be seriously considered. Dr. Dan McKenzie in a startling contribution to *The Lancet* in 1922 advocated drainage of the mastoid antrum in uncomplicated acute suppuration of the middle ear, which did not clear up within three or four days and proposed that this should be done preferably not later than ten days after rupture of drum membrane. While this may be theoretically correct, there are many practical objections to such impetuous operating as this. McKenzie was apparently not influenced at all by the type of bone and four days does not seem to be giving Nature a fair chance. There must, however, be some limit to the time within which a Schwartz's operation can be successful. The longer the suppuration has continued, the greater the damage to tympanic structures and the less the chance of complete restoration. There are, of course, cases in which a simple Schwartz's operation no matter when performed, would have no chance of success. These are what we might term fulminating cases occurring, fortunately rarely, in the exanthemata and in which from the virulence of the infection bone necrosis is present from the beginning.

Influenced by the considerations outlined in these scrappy notes, I have during the last eighteen months performed the Schwartz's operation in fourteen cases of early uncomplicated *otitis media*. In each case the skiagram showed the bone to be of the acellular type. The time of operation was in the earliest case four weeks after perforation of the drum membrane and in the latest thirteen weeks after. All the patients excepting two did remarkably well in that the discharge ceased, the perforation closed and hearing returned.

Of the two cases in which a good result could not be claimed, in one (the earliest, with four weeks' otorrhoea) a muco-purulent discharge continued in association with catarrhal rhinitis and a blocked Eustachian tube. In the other case the discharge ceased, but a large perforation refused to close.

The only point in the operation to which I need refer, is that the mastoid antrum is the objective, the bone, being acellular, a comparatively small area only needs to be excavated to uncover this.

It is better to use a small rubber drainage tube rather than gauze. This is retained for about ten days. If the tube becomes blocked with discharge, it can be freed with probe and syringe. After the tube is removed the wound may be allowed to close and it is not necessary to resort to gauze packing.

The Heath operation should yield good results in these cases, but there is this serious objection to Heath's operation: it leaves the way permanently open to tympanic infection via the meato-mastoid opening.

One does not feel justified in making dogmatic state-

ments based on the experience of only fourteen cases but, if the promise of good results from early operation is fulfilled in a larger series of cases, we should be no longer justified in countenancing a policy of "wait and see" in the treatment of the type of case reviewed.

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Section VIII.—Neurology and Psychiatry.

COMPARATIVE ANATOMY OF THE BRAIN, WITH SPECIAL REFERENCE TO AUSTRALIAN FAUNA.

Dr. Wm. Colin MacKenzie described and exhibited specimens from the collection of Australian fauna in the National Museum of Australian Zoology, St. Kilda Road, Melbourne, to demonstrate the comparative anatomy of the brain. The specimens included brains of Australian reptiles, monotremes and marsupials. After the enunciation of principles in which he traced the history of the erect position from the bearded lizard of Australia to man and stated that the basis of intelligence was a muscular one, since the great epochs from the reptile to the monotreme and along the mammals up to man were really dependent on muscular developments, the reptilian brain was first demonstrated and a distinction drawn between the brain of the bearded and of the frilled lizards and those of other reptiles. He then demonstrated how the overflow of grey matter took place in the monotremes, so that the white matter became internal unlike that of the reptilian brain in which it was external. The origin of the *corpus callosum*, pyriform lobe and *fimbriatum*, the *septum lucidum* and fornix, the front of the human brain, the early double motor relay or striate body and the necessity for the separation of the thalamus into two divisions as in man were demonstrated. In addition to the numerous original specimens, diagrams and lantern slides were shown, and a cinematograph record illustrating the movements of the platypus was displayed. The moving pictures illustrated the uses of limbs not only for progression but for support.

DR. PAUL DANE said that it had been a very great pleasure to have been associated in some small measure with Dr. MacKenzie in his work on the Australian fauna. He would like to emphasize not only that this work on the brain had been rendered possible by his wonderful powers of imagination, but by the superlative powers of anatomical dissection displayed by him. It would pay any member of the section to visit Dr. MacKenzie's museum where they would find that he had done a stupendous amount of work with the ability of an artist. After listening to many suggestions from him and studying his specimens, he felt that they would have to take into serious consideration the factor of muscle sense and all it meant in the development of the cerebrum.

The facts of Helen Keller's development tend to show that what they commonly called the special senses, vision, smell, hearing, were not apparently necessary for the

development for the higher function of the cerebrum, such as ideation, imagery; what she did possess was her muscle sense and by it her thought processes were carried out. After all every special sense with perhaps the exception of smell, would be impossible without muscle action. Further research would show that the basis of intelligence was largely muscle action.

The President congratulated Dr. MacKenzie and said that discussion was very difficult as the subject was one that Dr. MacKenzie had all to himself. Members examined the specimens with great interest and plied Dr. MacKenzie with many questions concerning them and their scientific interpretation.

THE EVOLUTION OF THE LANGUAGE MECHANISM.

By S. V. SEWELL, M.D., B.S. (Melbourne),
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IN discussing the subject of the evolution of the language mechanism time will only permit of very brief description of the evolution of the human cerebral cortex. As Sherrington has so ably pointed out, the receptors of the head segments are always dominant. This is of great importance to the animal, since it is the head which leads in any exploration of the environment. As the complexity of the environment increases, not only are tango-receptors provided on the head segments, but distance receptors, namely those of smell, which are stimulated by infinitesimally small particles emanating from objects at a distance, and the visual and auditory mechanisms which are stimulated by certain limited wave lengths. For the lower vertebrates the sense of smell is all-important if the animal is to maintain its position in the animal kingdom and most of its anticipatory reactions, both in search of food and its mate, are carried out as the result of reflex stimuli arriving by way of the olfactory nerves. Accordingly it is very natural that the interrelated mass of nerve cells or brain of such animals should be built up round the end-stations of the olfactory tract. The animal possesses what may be termed a smell brain. Such a brain is built up on an infra-granular basis and even in the adult form there is no differentiation of supra-granular layers.

As the complexity of the environment of the animal increases and its range over the land becomes more extensive, there is a fairly rapid development taking place in connexion with the end-stations of the other distoreceptors. Information received by visual and auditory pathways becomes of increasing importance when the animal has to search for its food and anticipate the attacks of its enemies. In this connexion it is interesting to remember that Krause has estimated that in primates there are considerably more fibres in one optic nerve than in all the posterior nerve roots of one side of the body.

Accordingly here is built up round the visual and auditory end-station the neo-pallium corresponding to the cerebral cortex as we know it, in contra-distinction to the archi-pallium or smell brain of lower types. This cortex is also built upon an infra-granular basis, but throughout the mammalian phylum there is a further differentiation of the supra-granular cortex into a very definite first and second layer. Until the stage of carnivora is reached,

there is very little differentiation of cortex except actually in the projection areas. As Campbell has pointed out definite zones of differentiation appear round the projection centres for the first time among carnivora, who show by their increased educability very definite capacity to use these associational zones for the storage of sensori-memorial impressions.

Ascending the phylum to the higher apes the most remarkable change that has taken place in the cerebral cortex, is the great increase in the area occupied by these associational zones, so that the projection areas come to be very widely separated, while with the assumption of the upright position the sense of smell has become of so little importance that the smell brain almost disappears till in the human brain it is very insignificant. However with the freeing of the fore limbs which takes place when the upright position is assumed, there occurs a very definite increase in size of the parietal lobule which is the afferent projection centre, for the infinite variety of epicritic and proprioceptive stimuli arriving in the cortex as the result of the skilled activities of the fore limbs. In the human brain a still further development of the posterior associational zones has occurred as a result of which the visual projection area is pushed backwards on to the mesial surface and only persists in relation to the calcarine fissure. However the most important difference between the cerebrum of the highest ape and that of the normal human is the addition of the highly developed pre-frontal lobe.

The human cerebral cortex is built up of five main layers and differs from that of lower mammals mainly by reason of its well developed second layer of pyramidal cells. This layer is first developed in the projection areas, but is much deeper and better developed in adult life in the visuo-psychie or posterior associational zone and in the pre-frontal lobe or higher associational zone. Its depth is fairly constant in the visuo-psychie area from individual to individual even in milder grades of mental deficiency. In the pre-frontal area, however, this layer varies greatly in depth between so-called normal individuals of differing educability and is very poorly developed in persons with amentia and undergoes progressive devolution in persons with dementia.

To the second layer of the cortex, with its innumerable neuronic complexes, we ascribe the storage of the infinite variety of sensori-memorial images which make up the mind content.

To the second layer of the pre-frontal lobe we ascribe those highest functions of concentration, of inhibition and of voluntary selection and rejection of suitable and unsuitable sensori-memorial images, the product of posterior associational activity: Injury to or destruction of this area allows the posterior associational areas to "free-wheel" and the patient becomes a prey to chance afferent stimuli. Thus judgement and concentration are lost and he becomes largely a creature acting on impulses and without control of sexual instincts, the whole personality being completely changed.

The intermediate frontal area (Campbell) in which is included Broca's area is not truly psycho-motor in function, but is probably responsible for the elaboration of motor complexes for skilled acts and interference with

this area produces apraxia, of which motor aphasia may be regarded as an example.

The only objective signs of cerebral activity are the motor exhibitions of the individual.

Such exhibitions include those of emotional expression, automatic and instinctive actions and skilled movements, the result of education and experience. It is to the last that the skilled movements of speech and the speech mechanism belong. In connexion with this paper it is hardly necessary to discuss the mechanism of emotional expression except that the emotions are frequently partly expressed by articulation. Emotions are freely expressed, speaking phylogenetically, before the pyramidal tract is evolved and in new-born babes before the pyramidal tract is myelinated. We can safely say that the arc for emotional expression and automatic movement is the thalamo-striate arc, but by reason of the well-developed thalamo-frontal and fronto-thalamic connexions the emotions colour all our cerebral activities and are held in leash by the dominance of the frontal lobe, just as the neostriatum of the reptile allows control of the automatic movements constantly carried out in slightly lower types by way of the thalamo-palidal arc.

All races of mankind have some form of language for communication one with another. It is a big step from the gesture language of the lowest type of savage to the extensive word and phrase vocabulary of that finest product of evolution, the educated upper middle class English gentleman, but in all cases it is a symbolic mechanism evolved for the integration of thought.

Similar but less complex symbolic systems are those of the mathematician and musician. A word *per se* is simply a sensation, either auditory, visual, cheirographic, kinæsthetic or articulatory-kinæsthetic. It only has meaning and is understood when it integrates present and past percepts by reviving past sensory images. The resulting percept on the presentation of a word varies almost inevitably on every occasion owing to the infinite variety of possible neuronic complexes which may be established.

It would be interesting to know the resulting complexes established by the presentation of the word horse among members of this community at present at the height of the racing season. Although the end result is different on each occasion, the process of perception is the same.

An infinitely more complex use of words is for the evolution of a concept or general idea. Here words are used to integrate numerous related past percepts as for instance in the evolution of such a conception as beauty.

Words come to have very different significance in their power to rouse the thought mechanism. Simple conjunctions, prepositions merely arouse their own visual or auditory word picture, while proper and abstract nouns will arouse a whole series of past percepts and concepts by reason of the numerous inter-neuronic connexions they immediately establish. Speech is acquired by imitation and the association of the auditory and articulatory centres and in individuals who have not learned to read or write the whole vocabulary is acquired through auditory channels. Among educated people, however, the word and phrase vocabularies are greatly increased by reading and writing. Among educated people therefore the language mechanism can be influenced by at least four afferent

avenues, the auditory, visual, cheirographic-kinæsthetic and articulatory-kinæsthetic.

In ordinary conversation words rise to consciousness by way of the auditory pathway, but unless they arouse a whole series of related percepts, they are not really understood and are not being used for the purpose for which they have been evolved, namely as a short hand mechanism to integrate thought. It is not too much to say that the majority of people pass their time idly repeating what they have been told or read without even having the remotest idea of the real meaning of the views they are expressing.

In the voluntary use of the language mechanism words invariably rise to consciousness by way of the articulatory or cheirographic-kinæsthetic areas as some motor effort is essential to start the thought mechanism. The psycho-motor effort thus made is dominated from the pre-frontal area and so percepts and concepts not in harmony with the concentrated line of thought are constantly being discarded and disregarded by conscious psycho-motor interference. Thus by voluntary effort the line of thought is kept to the pathway desired.

How often on such occasions are we conscious of the fact that what we write or say is not quite expressing what we really mean. The real fact is, that our thought processes have not been completed and, while we may be conscious of the fact that our words are inadequate, still, when some chance stimulus, possibly from the words of another, clarifies our thought, then the words come readily enough.

For the expression of an abstruse thesis the language mechanism is being used for its proper purpose, to integrate thought and without this mechanism clear thinking is impossible. Hence in aphasia of however mild a degree there is always some intellectual defect.

Sense deprivation has a remarkable effect upon the language mechanism. In congenital cases deafness necessarily means dumbness unless the individual is specially educated by the visual pathway to lip-read. Such education, being through an abnormal pathway, is always difficult. Individuals seldom develop great intellectual capacity and the brain by reason of the unusual strain put upon it readily undergoes devolution. In a large percentage of cases dementia results. Deafness acquired later in life among individuals who cannot read or write has a very crippling effect upon the language mechanism. The individual tends to become increasingly quiet and morose and dementia frequently follows on the disuse of the language mechanism.

The congenitally blind, on the other hand, learn to speak very much in the same way as the normal child by the auditory pathway and throughout life as far as the language mechanism is concerned, are largely in the position of the individual who has not learned to read or write. Many such people with the aid of Braille reading become intellectually very little inferior to highly educated normal individuals.

It must be clearly understood that the centres referred to in discussing the language mechanism, are simply storage areas for different forms of sensory impressions and that the whole mantle of the cortex is necessarily involved during the employment of the language mechanism for the integration of thought. Any interference

with any part of the language mechanism necessarily has a maiming effect upon the whole and produces some intellectual defect. However, since the word vision area only comes fully into use when the individual learns to read and write, the power of reading may be lost as the result of a lesion of the occipital lobe, without the same interference with the speech mechanism and with less intellectual defect than occurs when other parts of the mechanism are involved.

PROFESSOR J. I. HUNTER said that Head's analysis of cortical injuries led him to the conclusion, that the four clinical types of disorder of speech were all the result of interference with symbolical thought and expression. He defined four clinical types of aphasia which merged into one another and all of which exhibited some intellectual defect. The four types were (i.) verbal aphasia the main feature of what was defect in word formation, (ii.) syntactical aphasia characterized by jargon speech, (iii.) semantic aphasia in which the goal of speech was lost, the patient lost his memory of the final meaning of what he said and (iv.) nominal aphasia, loss of understanding of the nominal value of words.

In recent, as yet unpublished work, he had shown that the persons exhibiting these types of aphasia had cortical injuries in the inferior frontal region in verbal aphasia, in the upper temporal region in syntactical aphasia, in the inferior parietal lobule and three gyri inferior to it in semantic aphasia and in the pre-visual area in nominal aphasia.

The aggregate of these demonstrated how aphasia might be produced of some degree or other by injuries to widely separated regions of the cortex. It was possible by means of endocranial casts of primitive members of the human family to see the development of the zones already described in turn. The verbal area was well developed in the apes and in man. It was possible, therefore, to begin with the zone concerned in sound production and was utilized in performing symbolic speech as the other zones attained their development. If the endocranial casts referred to were compared with that of a gorilla, the most significant difference was a great increase in bi-temporal width due to the upper temporal (syntactical) zone having undergone a great expansion. This was seen in *Pithecanthropus* and *Eanthropus*. *Homo rhodesiensis* showed an expansion of the inferior parietal (semantic) region, while in these three forms and in the Neanderthal man the pre-visual (nominal) area had not attained its full degree of development. A parallelism therefore seemed to exist between the clinical phenomena of speech affections and the evolution of certain association regions of the cortex connected with symbolic thinking and expression.

THE DIAGNOSIS IN LETHARGIC ENCEPHALITIS.*

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I find myself entered under the Neurological Section to speak on this subject of lethargic encephalitis. I will confine myself to the question of neurological diagnosis. All true-blue neurologists desire to trace symptoms and physical signs to a single lesion, and there is a saying that if you diagnose two lesions during life, you must only expect to find one at a pathological examination.

There are, of course, numerous exceptions to this, but it is a wholesome principle.

One of the earliest full English accounts of the disease, after its independent descriptions by Harris and Hall, was issued by the Local Government Board in 1918, for which McNalty did the clinical work. He, working on clinical neurological lines, divided his cases,—some one hundred and twenty,—into seven types, (i.) without localizing symptoms, (ii.) with third nerve palsy, (iii.) with seventh nerve palsy, (iv.) with long tract lesions, (v.) with spinal cord lesions, (vi.) with peripheral nerve lesions, (vii.) abortive.

Of these the second was regarded as most typical: lethargy and third nerve palsy, and McNalty made ingenious suggestions in the best neurological style for a single lesion explaining the two phenomena. A mid-brain lesion was required for the third nerve palsy and this was held to be likely to interrupt the afferent tracts in general on their way to the thalamus. If these were obstructed, inappreciation of the environment and consequently lethargy was likely to result and also any attempts at cerebation, unguided by information from the environment would be uncontrolled and manifested as delirium, comparable perhaps to the logorrhœa of the sensory aphasia of Bastian's classification.

McNalty's other types were due to lesions in other sites besides the mid-brain, but presumably such a lesion was always present to account for the lethargy.

Later observations I think hardly bear this out. In the series of twenty cases published by Hume, Nathan and Shaw with four *post mortem* examinations diagnosis is advised to be made wholly by exclusion. They give seven main symptoms, at least two of which must be present. They are (i.) fever at the onset, (ii.) mental change, (iii.) lethargy, (iv.) Parkinsonism, (v.) myoclonus, (vi.) neuritic pains, (vii.) and last, ophthalmoplegia. At their four autopsies in only one was there a mid-brain lesion, but the areas of infiltration were very widely distributed. They point out the frequency of localized œdema on account of which no doubt very variable transient pareses may occur. In his recent Lumleian lectures Hall notes the very minor degree of actual ophthalmoplegia that occurs, there being rather disturbance of muscular synergy than actual paralysis.

All this rather knocks the bottom out of McNalty's original suggestions and adds very much to the difficulties of diagnosis. And diagnosis is important. McNalty collected in all over three hundred cases which might conceivably be lethargic encephalitis, and rejected more than half of them as due to polymyelitis and other diseases. Among his rejections were about thirty cases in which cranial nerve palsies and lethargy were present. In round numbers, then, at an epidemic period one hundred and fifty patients manifested evidence of lethargic encephalitis of whom thirty or 20% had quite other diseases, chiefly tuberculous meningitis and cerebral syphilis. If then we assume that all cases of lethargy and cranial nerve palsy are due to *encephalitis lethargica*, we must expect 20% of error at epidemic periods and probably much more at other times. Hume again had two cases which he at first proposed to include in his series; one of the patients had a tubercular tumour in the mid-brain and the other a cyst

of the third ventricle. He insists on the extreme importance of ophthalmoscopic examination, since in his experience neuritis never occurs in this condition.

I recently had the case of a man subject to days of lethargy, vomiting, vertigo; he had some cranial nerve palsies and extensor responses. His discs were normal. But his blood and cerebro-spinal fluid both gave a "++" Wassermann reaction and he is improving under specific treatment. The diagnosis of *encephalitis lethargica* would have been a serious blunder.

For reasons like this it is clearly very undesirable that this diagnosis should become the rag-bag into which obscure nerve cases are to be shifted with the label of "after effects," especially since no treatment appears to be of any service. It is very easy to get a story of an attack of influenza two years ago and on inquiry the patient remembers that he saw double at the time; easy but unreliable.

Often enough the diagnosis is attractive. I have at present these two patients under observation. A woman of fifty who gives that history and who is now suffering from typical *paralysis agitans* of mild grade. What is particularly exasperating to her family is a habit she has developed of making a "humming" noise, which seems to be of the character of a tic, as it can be stopped at will.

The second is a woman of forty who had an alleged "meningitis" a few years back; there is no record from any qualified man. Since then there has been a progressive apathy, loss of interest, neglect of her person and so forth, albeit she is perfectly sane. She has a tremor of the lips, increased deep reflexes throughout the left side and a left extensor plantar response. This patient also has a kind of tic; she has a habit of turning up the eyes upwards and to the right, very slowly. This might conceivably be "looking to the lesion," but the movement can be controlled if she is sharply called upon.

I hesitate rather to call this a tic, but it is a slow kind of movement quite comparable to the "hum" of the other patient and I should be interested to know if other people having noted similar disabilities.

I also had charge of a young girl with cranial nerve lesions, lethargy, absent deep reflexes and tender calves. This patient died; no *post mortem* examination was permitted and a satisfactory diagnosis was never reached. I raised the question at the time as to whether she was suffering from lethargic encephalitis of neuritic type, but I think tuberculous meningitis was more probable.

Since we are dealing with an untreatable disease, it seems to me to be of the first importance that all other diagnoses should be exhausted before we fall back on that of lethargic encephalitis.

THE CORRELATION OF RECENT ADVANCES IN CEREBRAL STRUCTURE AND FUNCTION WITH FEEBLE-MINDEDNESS AND ITS DIAGNOSTIC APPLICABILITY.

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TILNEY AND RILEY in their "The Form and Functions of the Central Nervous System" say: "The anatomy of

the nervous system to many physicians and medical students is reminiscent of struggles with complicated parts of the body which seem to have little practical value. It has an established reputation based upon its difficulties rather than upon the advantages of understanding it. Yet every phenomenon of human life is to some degree regulated by the nervous system, and there are few diseases which do not manifest defects in its controlling influences."

Every branch of study shows that the structure of the nervous system is everywhere built up of a series of long conducting neurones connected together by a series of shorter ones. The former comprise the receptor and effector neurones, the latter the internuncial. Medical and physiological attention has so far at all events been chiefly devoted to the long conducting neurones, because lesions occurring therein have been fairly obvious and are of every day frequency. In the study of the phenomena of mind and its aberrations, that is of the normal or abnormal reactions to the environment, it is, however, the shorter internuncial neurones which become of supreme importance, and to these an altogether insufficient amount of attention has been devoted. It is, of course, in the human cerebral cortex that a sufficient number of such neurones are found massed together so as to give those special reactions to the environment which we term "mind," and yet, notwithstanding that in no part of the human body is function so strictly dependable upon structure as in the nervous system, we find that human cortical histology is to the present day student of medicine a repellent subject, never understood and to be forgotten as soon as the exigencies of examinations permit. It consequently follows that the medical profession only very imperfectly realizes the importance of the correlation of cortical structure and mental function and is thus placed at a disadvantage when called upon to examine the phenomena of mind and its numerous aberrations and yet all mental phenomena are strictly conditioned by a highly complex series of neurones linked together in series of arcs.

Between the primitive type of central nervous system with its purposeful reflex unconscious actions as seen in the earthworm and the highly complex brain of man with its manifestations of speech, thought, reasoning, delayed reaction to the stimulus, memory and so on there is an immense gulf. So much so indeed that it is not uncommon to find the human mind spoken of, especially by those with no knowledge of brain structure, as though it were something which had no physical basis whatsoever, but was the result of a psyche or soul, whereas the simple truth is that every living animal possesses a nervous system strictly correlated with its requirements and environment and there is a perfectly orderly procession of animals from the earthworm to man with an ever increasing number of neurones, chiefly congregated together at the cephalic end of the neural tube, to which the mental reactions of the animal man included are strictly due.

In this evolutionary progress Cajal has directed attention to the fact that five epochs or types of neuronic arcs can be recognized as the several stages through which nerve control has passed.

The first of these epochs is that of irritability as typically seen in the *Porifera* or sponges. Here a stimulus, chemical or physical, received by a receptor cell on the surface of the organism, is immediately transmitted to an effector cell which contracts immediately in response to the stimulus. It should be particularly noted that the effector response is an immediate one and that there is no interposed tissue between the receptor and effector elements. If this type of reflex be present at all in man, it is to be found in the myenteric reflex of the gut wall. In any case the purely local reactions which occur in the walls of the intestine after section of all the nerves leading to them, must depend on a nerve mechanism different from that of other visceral reflexes.

The epoch of the reflex arc is typically represented in man by the direct junction in the spinal cord of a pre-ganglionic receptor neurone of the autonomic nervous system with an effector pre-ganglionic neurone without the interposition of any interpolated or internuncial neurone whatsoever. This type characteristic of some invertebrates is admirably adapted for the immediate response of several parts of the body to a single receptor stimulus and the resultant action is immediate, purposeful and unconscious. It forms the basis of many of the visceral responses in man.

The third epoch, that of the intersegmental reflex neurone, is characteristic of the nervous system of the common earthworm and is typically represented in man by the peripheral-nerve spinal-cord reflex arc. Here one receptor neurone passes into the spinal cord and there establishes connexion with one or more internuncial neurones which transmit on to the effector neurone. The resultant action is again purposeful, unconscious and usually immediate. On account, however, of the interpolation of an internuncial neurone, there is now the possibility of branching discharge of the receptor impulse to other segments of the cord apart from the one specially concerned.

Up to this time in the development and evolution of a nervous system there is no appreciable interval between the receipt of the stimulus and the despatching of the motor or effector impulses, so that the reflex act has an immediate consummation in motion which enables the animal to react to the environment in the manner most suitable to it. In the higher animals such an immediate response to the stimulus would often be disadvantageous to the animal's welfare and it becomes, therefore, essential to the well-being of both mammals and man to have a period of latency between the receipt of the stimulus and the motor or effector reaction. This pause in the reflex action, this period of latency, furnishes an interval, as it were, for reflection and allows of a selection of the most advantageous motor reaction. This is essentially the first step in introducing a more plastic type of behavioural reaction. The new element which so produces the period of latency by holding in check the effector response to the stimulus until the most favourable moment has arrived for its accomplishment, provides the important factor of inhibition or delay in the response which has attained its highest development in the brain of the normal man, but not in the brain of the abnormal man. The neuronic machinery by which this is brought

about, consists in the addition of an enormous number of supra-segmental neurones of an internuncial character interposed between the receptor and effector limbs of the arcs and collected together into successively added end-brains. When this epoch has been reached, that is the fourth epoch or the epoch of the supra-segmental reflex neurone, the nervous system has clearly come under the guidance of a new influence and has acquired the far-reaching quality of being able to withhold action until it is most opportune and profitable.

Behaviour is thus no longer a matter of instantaneous impulse, but is made subject to a certain degree of supervisory review, guided by a primitive form of judgement which may be taken to mark the beginning of psychic life. The histologically tri-laminar cerebral cortex of the mammals and the infra-granular cerebral cortex of man are examples of the epoch of the supra-segmental reflex neurone.

The final step in the centralisation of the nervous mechanism, enabling it to attain the consummation of its functional capability, is reached with the addition of the psycho-associational neurone and attains its highest development in man, particularly in the supra-granular cortex of the association areas. By this means numerous associations are made possible between the various types of sensibility, including somæsthetic sense, vision, hearing, taste and smell out of which the individual is constructed and upon which the foundations of all the higher faculties rest.

If the brain of a primitive mammal be viewed from its lateral aspect, it will be found that the major part is composed of the smell-brain or rhinencephalon. The remaining portion, the neopallium, comprises an auditory or acoustic centre, an optic or visual centre, a sensorimotor centre and a controlling centre. These last are the primary sensory areas of the neo-pallium. The brain of such a primitive mammal, is, therefore, little more than an integrating nerve mechanism by means of which the living organism is brought into contact with the world around it and with the natural phenomena of that world, such as light, sound, temperature, odours and so on. Even such a brain enables the animal to perform the main and essential functions of its life, namely the acquisition of food and the reproduction of its species and practically every reaction the animal makes towards its environment, that is, its behaviour, may be interpreted in terms of these two great necessary functions of life.

But all these same areas or centres are present in the human brain and present an almost exactly similar structure and further the reactions of the human being to the environment may be similarly interpreted in terms of hunger and sex. The male goes to work. Why? Clearly to obtain money to buy food for the gratification of his hunger. He is not allowed by his fellow men to steal the food and therefore necessarily proceeds to the more legitimate method of working for the wherewithal to gratify his hunger. The female marries in order to perpetuate the species. Civilized law frowns on the more animal tendencies to promiscuity and so, perforce, normal men and women abide by the law as regards the gratification of both hunger and sex. It should, however, be particularly noted and remembered that the cerebrally

abnormal do not abide by the statutory laws in these respects.

As all these areas are present in the brains of both primitive mammals and man and give as regards the environment almost exactly the same reactions, why then is it possible to teach the human child to speak and to think and is impossible in any other animal? The answer is simple. Man is the only animal, living or extinct, who has been endowed with a sufficiency of neurones for the purpose and even then such neurones have to be most laboriously taught to perform these functions. If they are not so taught, there will be no speech. If the neurones are insufficient from the outset, the child will not acquire the faculty of speech until a much later period than usual and his vocabulary and intelligence will be severely limited, in other words he will be an imbecile and lastly, if the neurones be destroyed or damaged subsequent to the acquisition of speech, the faculty will necessarily be lost or impaired. In the process of evolution there have been evolved around and between the primary sensory areas of the neo-pallium secondary or association zones which attain their greatest size and highest development in the human brain, and give to it its great mass. It is within these secondary or association zones that the mental processes of memory, reason, judgement, speech and other manifestations of intellectual phenomena, as apart from the purely physical functions of life, arise and are carried on. Man, therefore, shares with all mammals the purely animal properties of hunger and sex, but differs therefrom in the acquisition of speech and the powers of control over his more purely animal reflex instinctivities.

These functional differences between man and the animal are strictly reflected in the cerebral cortex. In the animal there is a tri-laminar cerebral cortex with no association areas. This subserves the animal functions referred to. In man there is a great extension of this tri-laminar cortex into association areas which thus not only performs the same functions as in the animal, but is also capable on account of its much greater extension of serving as the primitive basis of speech and the lower psychic properties. It should be particularly noted that the imbecile in whom the additional two layers of the controlling supra-granular layer are below normal in development, usually possesses a limited vocabulary which is largely composed of obscene and other words relative to the primitive and animal functions.

The mammalian cerebral cortex is, therefore, composed from without inwards of three histological layers:

A granular layer composed of Golgi type II. neurones strictly confined to the grey matter and receptive in function, that is storehouses of incoming nerve impulses.

An inner fibre lamina composed of medullated axones conveying receptor and other impulses from all portions of the body to the cells of the granular layer and thence to all other portions of the cortex.

An inner cell lamina composed of polymorphic cells. G. A. Watson proposes to call the last two layers the infra-granular cortex and from his extensive studies on the structure and functions of the mammalian cortex concludes that the infra-granular cortex, omitting the constituent cells which possess motor or analogous func-

tions, is concerned especially with the associations necessary for the performance of the instinctive activities, that is all those which are innate and require for their fulfilment no experience or education. These form the basis of many complex actions necessary for the preservation of the individual and the species, such as the seeking appropriate shelter and protection, the hunting for food and the quest of the opposite sex, that is, in two words hunger and sex. It is believed that lower mammals have provided in the infra-granular cortex which is relatively as fully matured at birth in them as in man, a sufficient cerebral cortical mechanism for the performance of these lower associations. "It is, therefore," says Bolton, "impossible to avoid the conclusion that the inner cell lamina is the fundamental cell-layer of the cortex and that it is concerned with the performance of the instinctive in contra-distinction to the receptive, the psychic and the voluntary-psychic activities."

The Infra-granular cortex is, therefore, in the human being the brain of the animal instincts, that is of those purely animal passions which are inherent in every human individual and are essential for the preservation of the species. On account of its extension into association areas it also subserves the more elementary properties of speech, particularly of those words and phrases associated with the animal instincts. As regards its histological features its micrometric thickness is of extremely constant average (Bolton). That is to say the number of constituent and contained cells is very constant, but "a very slight decrease in depth exists in cases of high-grade amentia and of chronic insanity with moderate dementia. A considerable decrease, on the other hand, exists in more marked aments (idiots and imbeciles) and in gross demented unable to carry on the ordinary animal functions, such as attending to their own wants. In these cases the number of the constituent cells of the infra-granular cortex is clearly decreased, and the behaviour or reaction of the individual to his social environment is correspondingly altered.

In the process of evolution two other layers have been added to the primitive tri-laminar cerebral cortex which thus becomes converted into a five-layered brain. The five layers, as seen in the human brain, are as follows: (i.) The outer fibre lamina and (ii.) the outer cell lamina, comprising the supra-granular cortex; (iii.) the middle cell lamina, comprising the granular cortex and (iv.) the inner fibre lamina and (v.) the inner cell lamina, comprising the infra-granular cortex.

Except for the fact that the constituent cells of the outer cell lamina are pyramidal and not polymorphic, the essential constructional details of the supra-granular cortex do not differ from those of the infra-granular. In both there is an incoming fibre lamina—line of Bailarger—composed of medullated receptor and other neurones. The granular layer forms a storage layer for nerve impulses common to both layers. In both there is a constituent layer of special nerve cells—polymorphic in the one, pyramidal in the other. In both there can be seen the constituent elements of the psycho-associational neuronic reflex arc in its very highest stage of development. In both there is every neuronic provision for the delay of the effector response to the receptor

impulse, that is for the inhibition of the response to the stimulus which is the essential feature of the phenomena called "mind." Lastly it is known that both supra-granular and infra-granular cortices differ in different human individuals in thickness, either from errors of development or as the result of disease. What is not, however, nearly sufficiently known or appreciated in the study of the insanities and those social aberrations classified as mental deficiency is that differences in the relative development of the two great cortices of the human brain give very different reactions to the social environment.

The supra-granular cortex is the prominent feature of the human brain and constitutes a higher level basis for the carrying on of the cerebral functions. It is the last cell layer to be evolved and the first to undergo retrogression. It is the only cell layer of the cerebral cortex which varies definitely in measurable depth in normal brains. It is underdeveloped to different degrees according to the mental capacity of the individual in persons exhibiting various grades of mental subevolution, that is other things being equal, such persons have evidence of physical stigmata such as measurably smaller heads, though the small head is not necessarily a sign of mental deficiency, and the layer itself undergoes degrees of retrogression which correspond to the amount of dementia existing in cases which permanently suffer from diminution or loss of their powers.

From all of this modern neurological work on the structure, evolution and significance of the cerebral cortex Bolton concludes thus:

As a summary of the results of my micrometric studies I would remark that the human cerebral cortex is originally evolved from three primary cell laminae: an inner or polymorphic (infra-granular layer) which is concerned with the performance of organic and non-voluntary activities; a middle or granule layer which is receptive in function and an outer or pyramidal (supra-granular) layer which serves as the physical basis of the associative or psychic functions of the cerebrum. The last of these, as has been shown by the investigations of Brodmann, of John Turner and of G. A. Watson is the distinctive feature of the cortex peculiar to the mammalia.

These three laminae appear during normal development in the order in which I have stated them, namely, from within outwards. In the visuo-sensory area it is an interesting and important fact that the middle or receptive cell lamina as would *a priori* be expected in normal evolution runs ahead of the others in its rapidity of development.

In cases of mental disease grading from idiots and imbeciles through various types of non-demented and partially demented lunatics to the gross dement, great differences in the degree of evolution and dissolution of the cortex exist; and these, considered from the general aspect, follow the order of normal development. In amentia the condition is one of sub-evolution to different degrees and in dementia the laminae suffer in the reverse order to that of their evolution, the most affected being the latest developed and the latest affected being the earliest developed.

As a final remark I would add that there is reason to believe that this physical basis of the cerebral functions which exhibits such well marked variations in the subjects of mental alienation, exhibits equally

important, though less extensive, variations in the case of presumably normal individuals; and this indicates the likelihood of a structural origin for individual differences in mental endowment.

As a result of this recent modern study of cortical histology there begins to emerge the highly significant fact that in every human individual there is a cortical brain (the infra-granular cortex) of the animal instincts and activities and a brain of control, inhibition and educability (the supra-granular cortex). Bolton has clearly proved that the neurones of this latter brain develop late and are extremely variable in number, hence it follows that some human individuals will react to their social environment on a more nearly animal basis than others and there is thus a clearly established physical basis for many social problems, such as certain phases of crime, prostitution and inefficiency. Further it may be stated that many of the problems confronting the alienist receive an illuminating light previously unobtainable when interpreted from this new view point, namely, the altered reactions to the environment consequent on a diminution from any cause whatsoever of the pyramidal, controlling and inhibiting cells of the supra-granular layer. It will be further found that many otherwise rather inexplicable cases of the neuroses and psycho-neuroses become quite intelligible when interpreted from the same standpoint, altered reactions from a deficiency of pyramidal cortical cells.

Almost every line of research has confirmed and supported the general histological conclusions of Mott, Bolton and Watson.

From the standpoint of ontogenetic development every human individual commences life as an idiot and if he lives long enough, dies an idiot. In the first instance, because his neurones are not sufficiently developed as to enable him to react in the normal manner to a normal environment. In the second, because his neurones are with advancing age in a state of dissolution, that is dementia is the ultimate fate of every human being who lives long enough.

Death is, therefore, a gradual process and overtakes a human being in the following order: (i.) Death of the reproductive cells, (ii.) death of the brain cells, (iii.) death of the bodily somatic cells.

When death or partial dissolution of the brain cells occurs abnormally early, there are produced such disordered reactions to the environment as to cause us to classify the condition as a form of lunacy and we term the condition dementia praecox.

Of histological evidence of imperfect development of the cortical layers of the brain there is an abundance. The cellular changes have actually been observed in *post mortem* examinations of the brains of aments by Mott, Tredgold, Hammarberg, Ellis, Bolton, Watson and many others. Sir Frederick Mott says, "In idiots who are incapable of articulate expression and abstract thought we find the anatomical basis of the psychic level, *id est* the millions of cells in the cortex, is arrested in development and we have a condition then of amentia or absence of mind. If we examine sections of the cortex we should find the supra-granular layer of pyramids especially affected.

Of the social significance of the truth of this recent neurological research there is again a super-abundance

of evidence. One example out of many must suffice. Three hundred and fifty-five criminals in a local penal establishment were found to have a cubic capacity of brain of 1,438 cubic centimetres, that is 5% less than the average which constitutes normality. It is not infrequently objected, though the objection can only arise from ignorance of neurological fact, that a difference of a few micro-millimetres in the thickness of the cerebral cortex cannot produce a measurable differentiation in the size of the living head. The would-be critic forgets that the supra-granular cortical layer is composed of pyramidal neurones, the axones of which all enter the white medullary centre of the brain where they become medullated or should do so and as Donaldson has shown, medullation is the chief source of increase in weight of the brain between birth and adolescence. As a difference of only a very few micro-millimetres in the thickness of the cortical layers means a difference of many million medullated axones it is obvious that the so-called "criticism" is not criticism at all, but is just an exhibition of that type of ignorance which so often mistakes itself for criticism. Further, as the development of the infra-granular cortex is almost complete at birth, it follows that the deficient brain capacity of these criminals is most suggestive proof of the fact that their controlling supra-granular cortex is grossly lacking in development. Their several crimes afford the most extraordinarily convincing proof of the truth of these doctrines. It has been shown that the functions of an uncontrolled infra-granular cortex are chiefly those associated with the purely animal instincts of taking what the animal sees or of reproducing its species. These three hundred and fifty-five criminals were found to have been committed for a variety of crimes, all of which can be resolved into two great series, crimes against the person, that is sex, and crimes against the property, that is the acquisition of food or the human equivalents thereof, and thus the crimes correspond in the most striking manner with the neurological teachings of the meaning and significance of the infra-granular cortex. The crimes may be classified as follows:

A. Crimes against the property.

(i.) Unskilled.	
Larceny	144
House and shopbreaking	26
Cattle stealing	6
(ii.) Skilled.	
Embezzlement	5
Forgery	14
Total	195

The disproportion between the unskilled crimes of petty theft (176) as against the skilled (19) is very striking, as is also the fact that the cubic capacity of brain of the criminals convicted of the unskilled crimes of petty theft was much smaller than those convicted of the skilled forms of crime.

B. Crimes against the person.

Sexual offences	56
Murder, manslaughter, wounding and assault	26
Inebriety	26
Total	108

The fact that more than one half of the crimes against the person fall at once into sex crimes is again very convincing evidence of the truth of the researches of Watson, Bolton and Mott, whilst it is almost certain that sex would have been found to be the dominating factor in most of the murder and manslaughter cases.

C. Miscellaneous Crimes.

There fell in this category another fifty-two criminals which again reveal the significant fact that all these crimes belong to one or other of the two great groups. Thus in the sexual group may be mentioned wife desertion, maintenance, bigamy and obscene language. In the property group there are debt, receiving, false pretences, gambling, vagrancy, impersonation and arson.

The last line of evidence in support of the truth of modern neurological teaching is the actual clinical study of the amentias. It need hardly be said that the more popular and lay terms of mental deficiency, feeble-mindedness, morosity and so forth should find no place in modern scientific medicine, however useful they may be for popular or semi-popular purposes. Bolton's classification based on clinical symptoms, supported by *post mortem* histological examination of the cortex itself is the only one which is strictly justifiable.

Under the division low-grade amentia Bolton includes those who are generally known as idiots, imbeciles and mental defectives of various grades and types, either with or without epilepsy and considers from a clinical standpoint the term is a better one than the more ordinarily employed terms "idiots and imbeciles," which have always been unsatisfactory. Feeble-mindedness he regards as a common mental state unknown to alienists.

Under the division of high-grade amentia Bolton includes moral unstable and excited persons together with cranks and asylum curiosities, recurrent cases of all types, hysteria, epileptic insanity and true paranoia and allied cases. It contains many persons whose condition is usually classified as chronic mania or chronic melancholia, but who exhibit developmental deficiencies that show themselves under the form of general mental or moral instability or perversion on the one hand or under that of curious and abnormal mental function on the other. It includes also the very large group of recurrent cases of mental disease, whether the individuals are still subject to periodic relapses and are temporarily under treatment or are permanently certified. Further this group contains persons suffering from hysteria and true epileptic insanity. "Finally, I have inserted," says Bolton, "certain cases of insanity with systematised delusions (developmental paranoia) and I believe that these also are developmental in origin and should be described amongst the highest types of amentia." The common physical feature of these various conditions is a more or less evident under-development of the cerebrum associated with the absence of intracranial morbid appearances.

A long clinical and laboratory experience has absolutely convinced me of the truth of these neurological dicta and I am entirely of Bolton's opinion when he says that the common physical feature of the amentias is an under-development of the cerebrum, due either to a lack of

development of the neurones, particularly those of the supra-granular layer, or to an improper functioning of the neurones from a very large number of general causes, such as poisoning from toxæmias, deficient glandular secretion, lack of chromatin, insufficient oxygen, syphilis and many others. Now it is impossible for an individual to react to his environment in a normal manner if his supra-granular neuronic development be below normal and it is a waste of time to conduct macroscopical *post mortem* examinations of the brains of the so-called insane, if the microscopical conditions of the cortex are to be ignored. Many of our so-called insanities are not insanities at all. They are disordered reactions to the environment from an insufficiency of cortical neurones and I venture to suggest that it is well worth the while of every alienist to study the insanities, the neuroses and the psycho-neuroses from this new neurological point of view, namely the altered reactions to the environment from a faulty development of the cortical neurones of the supra-granular layer. In any case there can be no question that it is on these lines and these lines only upon which the study of the so-called feeble-mindedness or mental deficiency should be studied, certainly amongst children.

In the diagnosis of amentia in children it has hitherto been the custom for lay psychologists to form an opinion from the application only of a Binet-Simon or other similar test and for certain members of the medical profession to rely on such tests, supported by a general medical examination or opinion. Personally I am entirely opposed to either procedure. In my judgement the diagnosis and prognosis of amentia amongst children up to the age of sixteen or eighteen calls for much skill and an adequate knowledge of modern neurology and in no case should the diagnosis be made by anyone but a medical man and he should have before him a complete medical and clinical history of the case and a full record of all those so-called psychological and physical tests which are known to give some indication of the probable state of development of the cortical layers of the brain. With all this evidence before him it is quite possible to form an accurate diagnosis of low or high-grade amentia and once the environment is known, as to the most probable manner of the child's future reactions to it. But even with all this before him the clinician will find there are many cases which a natural caution will induce him to place in a deferred diagnosis group. This is particularly the case with young children below eight or nine years of age. The nearer the patient's age is to puberty, the more accurate will the diagnosis be, but it is certain that if a child of eight or nine years be shown to be three years retarded on all counts, he will never make up that leeway and there is no crueller thing than for the clinician to assure the parents that the child will grow out of it. The proper thing is to find out wherein lie the child's best capabilities and to urge the parents to encourage these to the best of their ability.

From a very large number of clinical cases I shall quote the following as illustrative in every particular of the clinical methods I employ in the diagnosis of amentia and it may be pointed out that there is no single part of this method which has not been thoroughly tested in

the laboratory and is not accessible to any member of the profession. The case may be termed one of low-grade amnesia, undiagnosed by the original consultant.

The patient is a boy aged nine years and ten months, that is he is in the tenth year of life. He is an only child whose mother died when the boy was three years old. The father is still living.

The boy was breast-fed, suffered from no minor ailments, but fell out of his cot on to his head when he was seven months old. His grandmother thinks this may have affected the boy's mentality. Teething and walking occurred normally, but the child did not speak until he was five years old. Some years later the grandmother who has had thirteen children, one of them the boy's father, began to think the boy was not quite right mentally and took him to a medical man who failed to elicit any evidence of mental abnormality. As no improvement manifested itself, the grandmother was not satisfied and consulted a children's specialist who referred the child to me for a special report.

No ascertainable mental history could be obtained on the father's side and the relatives knew but little of the mother's side. It was stated that the mother and her family were "highly strung" and that the mother had a brother who did not speak until he was seven years old, but subsequently became a "clever dentist."

The grandmother stated that the boy was mischievous and destructive, could not be left alone with impunity and always required watching. He has twice wandered away from school. He cannot read and can only write his own name with difficulty. He does not appear to have developed any habits of thieving or lying and there is no obtainable history of sexual proclivities. He has been at several orphanage schools, but the authorities have eventually always requested his removal from the school. He has no playmates, but has a great liking for blue glass beads and is especially fond of playing with old jam tins, which he puts in straight lines. He seems to be best with his hands, can build up match boxes to a great height and is said to get an accurate alignment of his tins and boxes. Apart from this he does not appear to have any other special aptitudes, but likes to have pictures in books explained to him, particularly pictures of aeroplanes and is said to have a good ear for music.

The boy's mother died from "blood poisoning" when she was three months pregnant with a second child. This is attributed to the use of abortifacients which were also extensively employed without the success desired during the first pregnancy from which this boy was born.

Whilst the foregoing clinical and personal history was being elicited, my assistant was applying to the patient himself certain standardized tests and entering the same on the chart. These tests comprise head measurement, standing stature, sitting stature, weight, right grip, left grip and vital capacity. The boy's records under each count are carefully recorded, compared with the "norms" for boys of his own age and social standing and entered graphically in the form of percentiles. The patient's receptor abilities are tested by the Binet-Simon tests and the effector mechanism by the Porteus maze tests. The results are entered in the form of the so-called "intelligence quotients." Personally I do not regard these tests as intelligence tests at all, but as standardized tests of the receptor and effector neuronic machinery.

With all these facts before him the clinician is now enabled to pass to their interpretation.

As regards the observation of cubic capacity of brain, the bodily physique and the psycho-physical average, it is

at once clear that the patient is outside the standards of normality as regards the first and the last and is below standard as regards the second. The boy is, therefore, abnormally big-headed and of inferior physique and is strikingly below normality in psycho-physical average.

The examiner knows or should know that the factors affecting size of head are six in number, namely thickness of the soft parts of the scalp, thickness of the skull, the meninges, the amount of cerebro-spinal fluid, the number of neurones and the relative amount of neuroglia. The first three are negligible and are fully allowed for in the calculations. This boy's abnormally big head is due to one or other of the last three factors divisible into two chief groups: neurones on which mentality depends; fluid and neuroglia on which mentality does not depend.

A survey of the patient's chart shows quite clearly that in this case the abnormally sized head is not due to neurones. Further, the psycho-physical and mental tests prove an actual lack of neurones. Study of the ontogenetic development of the cortical neurones of the brain further fully proves that when there is an insufficiency of development of cortical neurones, it must be the supra-granular or inhibiting layer which is most at fault. The inference, is, therefore, that in this case we are dealing with a boy of under-neuronic development who is incapable of exercising control over his neuronic effector responses. That this inference is correct is supported by the failure of the boy at the Porteus tests and is borne out by the personal history that he is "mischievous, destructive and wants constant watching."

Lack of normal neuronic development is further fully supported by the gross failure at the psycho-physical tests, as well as by the low mental age obtained from the Binet-Simon tests. Further, the complete failure at the stereognostic tests of the latter system and the complete failure to understand the meaning and use of figures show that there is a lack of neurones in the parietal association area. The boy has no planning capacity, no foresight, can count up to nine, that is can repeat the words, but has no idea of their meaning, has a most confused sense of colour, calls a horse "pink" and yellow "white." The only things at which he has even approximately average ability are the recognition of geometrical forms and his alleged ability to distinguish musical sounds, as is proved by the tests themselves and the personal history.

With all this information before us there can be no doubt as to the diagnosis and but little as to the prognosis. The boy is a low-grade ament of the imbecile type, the condition being due to a probable general neuronic failure of development over the whole of the cortex, certainly in the supra-granular layer, induced possibly though not certainly by the use of strong abortifacients during pregnancy. The neurone is peculiarly susceptible to poisons.

The boy, being now ten years of age, there is no hope whatsoever of his neuronic development ever making up the leeway of backwardness. He will remain an imbecile. With the onset of puberty there may be strong sexual desires aroused over which there will not be an effective controlling neuronic machinery. It is, therefore, quite possible that the patient may some day find his way either into a police court or a mental hospital.

Apart from what has already been said there are one or two other features of this case to which attention may be directed.

Firstly, there is the fact that one medical man failed to elicit any evidence of mental abnormality. Whilst at-

tributing no blame, it is to be deplored that the medical profession does not devote more attention to a subject which has come to stay and is tending to drift into lay hands.

Secondly, the boy's abnormally sized head is due to an abnormal height and there is some slight reason for believing that this is occasionally pathognomonic of what the Americans call a psychopath or socially dangerous type of deficient.

Thirdly, this case affords strong presumptive evidence of the danger of locking the stable door after the stealing of the steed. Nothing will be done by society with this case until the boy has offended against its laws and usages, by which time it will be too late to endeavour to train along better lines the few abilities the boy does possess. Were society and the profession now to accept the diagnosis, of which there can be no doubt, the boy would be placed in an institutional colony or village community and we should be spared the cost of his possible future criminal depredations. The establishment of such institutions in Australia is one of the great needs of preventive and social medicine.

DR. J. W. SPRINGTHORPE said that the paper discloses an interesting state of affairs; the criminal Deeming was mentally affected, but the Government said that they want the pathologist to govern the law; besides the factor dealt with environment must be considered.

DR. J. ADEY in speaking of environment said that it would effect a normal brain normally, therefore an abnormal result must mean a brain defect. Many other factors including blood supply must be taken into consideration; such a condition as curable melancholia, was not due to want of neurones.

PROFESSOR J. I. HUNTER congratulated Professor Berry on his paper in going beyond anatomy and linking structure with function.

THE DETECTION AND PREVENTION OF MENTAL DEFICIENCY.

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WHEN we realise the social chaos which is caused in all communities by persons whose intelligence is below normal, we should take efficient steps to detect such persons before they become a social menace. The diagnosis of mental deficiency is, therefore, of very great importance and it is sometimes quite a difficult matter in the case of young persons with mild degrees of defect. The opportunities for the detection of feeble-minded persons come mainly from the schools, law courts, hospital clinics and from medical practice.

The school medical service is of great value in diagnosing physical stigmata which if uncorrected retard the education of the children. If the medical officers possess a psychological insight and training, they can often confirm the opinions formed by the teachers as to the capacity of the children to learn and they can, therefore, determine which children require education in special schools or special classes. Such work can often be as-

sisted by lay psychologists who should in all cases act in conjunction with and under the direction of the medical officers.

Opportunities should be given particularly at children's courts for the examination by psychiatrists of children appearing before them. Many delinquent children examined at this time will be found to be mentally defective and by ascertaining this fact the magistrate can be advised as to what line of action should be taken.

At the out patients' clinics of general hospitals many feeble-minded persons are frequently to be found. Their presence in the ordinary medical departments is not welcomed, but all large hospitals should have attached to their out patients' department a psychiatric clinic where such persons of defective mentality can be examined by psychiatrists. When the cause of their mental defect is found to be of a secondary nature and not due to primary amentia, the conditions can often be ameliorated by medical means. The presence of organic diseases can be looked for and any condition which is likely to be hindering mental development, can be treated. Advice can be given to the parents of such children as to their proper education and training.

Statistics derived from school medical examinations, police court findings and hospital clinics would soon demonstrate the need existing in all large cities and throughout the whole community for special facilities for the proper education of feeble-minded children.

Medical practitioners will find many persons of feeble mentality in their practices and it will be necessary for them to decide in each case whether the amentia is primary or secondary and to what extent in the latter case improvement can be hoped for and what form of treatment should be followed.

In recent years great advances have been made in experimental psychology and groups of mental tests have been devised by various authors. Some of the best known are the Binet-Simon tests, the Stanford revision of which has been made by Terman; the Yerkes point scale tests, the Healy form board tests and the Porteus maze tests. In applying these tests in different communities to those for which they were designed, careful adjustments must be made because the questions asked in one country, might not have the same bearing in another. Their main value is that they give us a reasonably accurate indication of the intelligence of the individual in a short time and we can thus give a prognosis regarding the educability of the child and advice as to future treatment and control.

It is to be remembered that the intelligence quotient, the numeral which describes the capacity of the candidate under examination for acquiring knowledge as compared with that of a normal person, remains practically stationary throughout life and therefore the estimation of this numeral allows us to give a prognosis with more accuracy than can be given on clinical observation alone. At the same time the life-history and conduct of the patient are often much more certain criteria than are his responses to laboratory tests. The value of these tests depends largely upon the experience and capacity for interpretation possessed by the examiner. An experienced physician is better able to estimate the patient's mental capacity from ordinary clinical observation than an inexperienced lay person applying a whole series of laboratory experiments.

Many of these tests can easily be applied by physicians with some training in psychological methods and if they will use them in conjunction with their clinical experience and observation, they will have little difficulty in arriving at a proper diagnosis regarding mental defect.

Certain lay psychologists, however, are inclined to claim that the medical examination is unnecessary in estimating mental defect and have styled themselves clinical psychologists, claiming the capacity to "diagnose" cases. In America such psychologists are very numerous. But in all the important institutions which I visited, the psychologists when employed always made available the results of their examinations to the medical officers who made the diagnoses.

In order to determine whether a person is mentally defective or not, the physician must examine the personal and family history of the subject together with the results of the physical and mental examinations. The predisposition to mental defect is often indicated in the family history, but if defect cannot be detected by actual observation, the factor of heredity should not be overvalued. A child of an insane parent might be retarded from lack of opportunity, ill-health, malnutrition *et cetera*.

The personal history is more important than the family history. Natal and prenatal influences, birth incidents, accidents and illnesses during childhood must be inquired into. The most important physical illnesses to be looked for are hemiplegia, epilepsy, meningitis and syphilis. The order of birth in the family is of little importance. The delay in walking and talking to the third year and uncleanly habits at this stage are suggestive of mental defect. This is of value in the diagnosis of young children and also as evidence in older cases that the condition was present from an early age.

Physical Stigmata.

Adenoids, defects of the special senses, malnutrition, previous illnesses might give rise to mental retardation. A complete neurological examination is often necessary. The temperamental aspects of the patient have to be considered in addition to intelligence.

In London the Binet-Simon tests, the Healy tests, the Porteous tests and word association tests are most frequently used. Some shortened modifications of these tests are useful for preliminary diagnosis. Form boards such as are used in the Healy tests are of value in showing how patients benefit by past failure. Many feeble-minded children persist in repeating their errors after having been shown them. The Porteous tests estimate the powers of foresight and planning and ability to concentrate attention on a given task. They indicate the capacity of the child for success in the social world rather than in school attainments. Word association tests can be applied better to adult and high-grade defectives than to children.

In diagnosing mental defect it is not sufficient to estimate by psychological tests alone to what extent the subject is mentally retarded. Some children may pass all intelligence tests up to their average age and yet may lack the power to care for themselves. The history of school or social inefficiency is, therefore, of more importance than the actual intelligence quotient obtained by tests.

Experience shows that no person with a mental age of

less than eight years is able to fend for himself. Some of them with this degree of intelligence can carry on under sympathetic conditions, while those with a nine or ten years intelligence are able to fend for themselves with a reasonable degree of supervision. In other words any person with an intelligence quotient of 75 to 90 would be regarded as dull and this together with evidence of vicious or criminal propensities would be sufficient to label him a moral imbecile. Children require special school education when their intelligence is retarded by two years up to the chronological age of seven or eight or three years above that age.

Prevention.

The various avenues by which mental defect can be discovered, will reveal the far-reaching extent of the problem. As medical men we are then faced with the most important problem for preventive medicine. What can be done to prevent an increase of mental defect in the population? The most drastic method to approach would be in the sphere of eugenics. Sterilization has been advocated and has often been tried in many countries. Most of the States of America have laws dealing with this matter, but many of them have been declared unconstitutional. In the city of New York they were inoperative for years and were recently repealed without opposition from any of the State charitable societies. Courts are loath to order the operation and even when they have done so, surgeons have refused to undertake it as the public are not ready for such an assault upon the life and liberty of the individual, even of the defective members of the community. Yet if the consent of parents or guardians responsible for feeble-minded children is obtained, there should be nothing put in the way of carrying out sterilization in suitable cases. For many years this has been the practice in many of the hospitals in America and elsewhere.

The prohibition of the marriage of mentally defective persons will not do much to help in the solution of the problem. While it is illogical and absurd to permit actual ailments to enter into the marriage contract, yet we know that a considerable number of the offspring of such individuals are illegitimate. As Professor Berry, of Melbourne, has shown, feeble-minded persons possess the animal instincts without the intellectual capacity for control and the mere withholding of the marriage certificate will not prevent them when the opportunity is available from indulging their sexual desires. Yet if the prohibition of marriage of such persons would not check their propagation altogether, it would do something in this direction and would also be an important factor in the education of public opinion regarding the responsibility of marriage. Greater care would thus be taken in inquiring into the health of antecedents by contracting parties.

The nation desirous of escaping degeneracy must sooner or later give serious attention to the mental constitution of its people and the manner in which this can be controlled by marriage laws. At present, however, our knowledge regarding hereditary transmission is inadequate, as is also our data regarding the antecedents of most people, especially where immigration is so extensively carried out. The physician is often able to give valuable advice as to whether the offspring of a particular union is likely to be healthy or otherwise. Advice of this sort is being in-

creasingly sought and it is the duty of the medical profession to be prepared to give it efficiently.

Treadgold says:—

It is to our profession that the State looks for advice and help regarding the future health of the State and I consider it to be at once our privilege and responsibility to speak on the subject of the propagation of the germinally unfit in clear and unmistakable terms, and so help to form a public conscience regarding the question.

So long as we are content to raise no voice against the marriage of the diseased, the degenerate, the habitual criminal and the chronic pauper and are willing to educate, feed, clothe and ultimately pension as many offspring as these persons see fit to produce; so long as legislation is permitted a free hand in doing everything calculated to diminish parental and social responsibility and to strike at the very root of any incentive to labour; so long as our law-makers and would-be philanthropists are blind to the folly of transferring the burdens and penalties inevitably following carelessness, improvidence, indifference, drunkenness and unlimited selfishness, from the shoulders of those upon whom they should rightly fall to the careful, provident and industrious members of the State—then so long will these classes (and these qualities) continue to be perpetuated, and their numerical ascendancy is simply a question of time.

Segregation.

Most legislation dealing with mentally defective persons fails in its usefulness because the State is not given power to control the children beyond eighteen years of age, just the age when they are likely to reproduce their kind. Yet no country to-day could contemplate segregation for a generation of all mentally defective persons. Besides the cost of such a proposition, there would be much public feeling against it. But it is essential that we should carry out intelligent segregation of feeble-minded children in institutions which will give them training to make them as self-supporting as is possible. The training should aim at preparing them to work in later life in colonies where they can be made comfortable and where a congenial environment can be created for them. They will then be content to live the remainder of their lives under conditions which will prevent them from propagating their species.

Such colonies are an important feature of the training of all up-to-date institutions in America.

The colony system in Scotland, where feeble-minded persons are kept under the supervision of the local authority in small country villages, is in many ways suitable to that country, but in my opinion it is not likely that such a system would meet with success in a country like Australia where the conditions of life in general are so much harder and where home life is so different to that of the small villages of Scotland.

It is generally recognized that defectives are for the most part manually-minded and that they will learn more by the use of their hands than by educational methods adopted for normal children. Modern institutions for the care and treatment of feeble-minded children have a different educational programme to that obtaining in normal schools. Much more practical work is given the children even from their earliest days, the whole aim being to make them efficient "hewers of wood and drawers of water" rather than attempting to give them an education of a

type which will be of no value to them. The aim of such institutions is to train the children for work on farms or in industrial colonies connected therewith. Very little supervision is required in such colonies over the conduct of the workers as they have been trained to live amicably together. The defective person is more likely to give trouble when he has to compete with his more intellectual brother than when he is able to acquit himself well in the presence of others of equal intelligence.

The colonies produce from their farms and workshops much material which is supplied to the State institutions or disposed of in the open market.

At Rome in the State of New York the colony system has been extended for the past ten years to the girls who during the day are employed as housemaids or factory hands in the neighbouring town. There has been little or no conflict with organized labour. The girls enjoy a measure of freedom and at the same time are kept under the care and control of the institution. It is claimed that their morals are as well safeguarded as in the institutions themselves. Even if occasional immoral practices should occur under such a scheme, it is a more satisfactory one than that which at present obtains in this country of allowing these persons to go adrift in the community.

Colonies of this type are not entirely self-supporting, but the cost of maintenance is cut down to half that in ordinary institutions. Thus colony life in general solves the problem of committing high-grade defectives to institutions for life and overcomes the natural reluctance of the public to permanent institutional commitment.

The Problem in Australia.

The problem for us in Australia is indeed an important one and at present very little is being accomplished. First of all it is necessary that a very careful examination of applicants for immigration to this country should be carried out. Not only should physical illnesses which are likely to cause immigrants to become a financial burden upon the State be looked for by examining medical officers, but also the mental condition and intellectual development of prospective immigrants should be carefully investigated.

School medical officers in our education departments should be able to detect cases of feeble-mindedness and when they have done so, provision should exist for the proper education and training of these deficient children. The establishment of special residential schools for the feeble-minded is an urgent necessity in all the States of Australia.

The larger city hospitals should establish psychiatric clinics in conjunction with the out patients' departments. This has already been done in the case of the Royal Prince Alfred Hospital in Sydney and one or two of the larger hospitals in Melbourne. Until special institutions are available for the treatment of feeble-minded children, the work of such clinics is somewhat limited to medical observation and treatment, but the amount of work that can even now be accomplished by such clinics amply justifies their existence.

The clinics also provide the opportunity for parents and teachers to obtain advice with their difficult cases, especially those where there is only a slight amount of mental defect.

Social service activities should be organized in conjunction with hospital clinics and special schools, in order that feeble-minded children who are not committed to special institutions, can be kept under a degree of observation which will prevent them from causing social disorder.

The intelligent use of segregation must be encouraged and the more thoroughly this can be carried out the more satisfactorily can the whole problem be dealt with.

A mental deficiency act is necessary along the lines of the 1913 Act of Great Britain. Such legislation is contemplated in certain States. The New South Wales Bill provides for the taking of a census of all feeble-minded persons in the community and for facilities for the care and treatment of all persons where necessity for this is indicated. The feeble-minded children of school age likely to benefit by instruction in special schools would be under the supervision of the Department of Education and those not likely to benefit by special institutions, together with adolescents and adult persons would be provided for under the Inspector-General of Mental Hospitals.

The Bill also provides that persons in gaol undergoing trial before a police court for any criminal offence who are found by two medical practitioners to be mentally defective, would be sent to an institution for mental defectives in lieu of undergoing imprisonment in gaol; also that where it appeared to the police that any person charged with an offence was a defective, the Court would be given such evidence as to the mental condition of the person charged as might be available and special facilities would be made for the examination of such person by a psychiatrist, when considered necessary.

Even legislation of this sort will not reach many of the milder conditions of mental defect, but if the special institutions and schools to be established are carefully planned and efficiently conducted the parents of these children will be glad to make use of them, so that there will be much voluntary segregation apart from the act. At present we are unable to advise the parents as to how and where they can obtain the proper type of instruction for their defective children and if we had suitable institutions, these parents would be very anxious to make use of them. If the education is conducted along modern lines, these children will be prepared for colony work where they will be self-supporting in adult life and thus will be kept under care and control and will cease to be a menace and financial burden to the community.

Besides the above measures which can be used to deal with the existing taint, we must from a medical point of view consider how the problem can be attacked at its source. We know that the main cause of mental deficiency is germinal impairment. The problem, therefore, becomes generally one of public health and hygiene.

We have seen that amentia is of two types, primary where development of brain has always been lacking; and secondary where lack of development is due to diseases or disorders of metabolism or external injuries before, during or after birth. Medical observation can often detect in the child the presence of actual disorders of metabolism due to toxic agencies or to deficiencies in the endocrine system and these conditions can often be corrected by treatment.

But it is far more important to recognize from the broad aspect of preventive medicine that the greatest cause of mental deficiency is deterioration in the germ plasm of the parents brought about by such physical poisons as syphilis, tuberculosis, chronic alcoholism *et cetera*.

Medical science has advanced considerably in the treatment of the effects of these scourges in the individual and this has gone contrary to Nature's method of eliminating the unfit. Our methods have preserved the unfit and allowed them to propagate their species with a tainted germ plasm, whereas formerly many of them would have become extinct before being able to become parents. The wider aspects of prevention of these diseases must therefore receive our serious consideration.

Also the evolution of society has outrun the evolution of the race. The world is living at a pace for which the body has not been prepared and excess and dissipation are the rule. These factors also tend to produce germinal impairment.

By improving the general health of the community, by investigating the wider fields of preventive medicine, by ameliorating the conditions of life and the general well-being of our citizens we as medical men will do most to prevent the conditions which at present lead to germinal impairment and thus to mental degeneracy.

LEGISLATIVE MACHINERY FOR THE CARE OF THE FEEBLE-MINDED IN GREAT BRITAIN.

By SIR JOHN MACPHERSON, C.B., M.D., F.R.C.P.E.,
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LEST I should mislead you with regard to the present administration of mental deficiency in Great Britain I would like to remind you that the *Mental Deficiency Acts* came into law in May, 1914, just three months before the outbreak of the war. The *Acts* were in a state of suspended animation during the war because the Government suppressed all sources of expenditure. After the armistice they began to be slowly put into operation, but it will probably be several years before the necessary institutions are completed. However, I wish you to understand that the *Acts* are in operation and very slowly defectives are being dealt with as the finances of the country will permit.

In 1914 just before the war the direct taxation on the people of Great Britain was £3 10s. per head; to-day it is five or six times as much and each man, woman and child in Great Britain is paying in direct taxation, apart from indirect taxation on tea, sugar and so forth, £18 to £20 per head, so that it is not possible for local authorities to carry out the provisions of the *Act* as they would wish.

For many years it had been pointed out that the state of mental defectives in Great Britain was a scandal and a danger to the community and in 1904 a Royal Commission was appointed. It sat for four years and published very bulky reports, but it was not till five years later that the first bill was introduced to deal with the subject. This bill was met with a storm of opposition and criticism by well-meaning but misguided individuals who were concerned for the doctrine of the freedom of

the subject. They succeeded in blocking the first bill, but later two bills were introduced and passed into law, one for England and one for Scotland. The method of administration differs so radically from that in Australia that I must in a very few words lay it before you.

It is a method of local government. The State does not build mental hospitals or institutions for defectives, the local authorities build them. The county is the unit of the local authority and in Scotland, which I know best, there are thirty-three counties and each county is charged with the duty of building its own institutions. The county also builds other forms of hospitals and schools.

Local government is further sub-divided into parish councils. There are some nine hundred to one thousand parish councils. They were originally ecclesiastical areas and it was only towards the middle of last century that legislation conferred upon elected bodies the functions previously performed voluntarily by the churches.

The parish council administration is limited in this respect to the care of the poor, the sick and insane within its area. It acts *in loco parentis* to every person who is too poor to pay for his own maintenance in a mental hospital or fever hospital or an institution for defectives. It looks after the individual who is unable to look after himself. It is a very good principle because who is better able to judge whether a person is deserving of sympathy and assistance than the people among whom he lives. The third local body is the education authority whose area is also the county.

In addition to the three local authorities I have mentioned there are the following government departments, the Board of Health which deals with health, the Board of Control which deals with lunacy and the Education Department which deals with education. These Government Departments have no executive powers, but as they allocate the various grants, they have the power of the purse. They have also the power of criticism and of investigation. Now, I think you will be able to understand the conditions of local government in Great Britain which differ so essentially from the centralized method of government here.

In the first place the *Act* defines who the people to be dealt with are: (i.) Idiots, that is to say persons who from birth are so mentally defective that they are unable to protect themselves from ordinary physical dangers, (ii.) imbeciles, that is to say persons who not being idiots, are so defective that they are incapable of managing themselves or their affairs or, in the case of children, of being taught to do so; (iii.) feeble-minded persons whose mental defectiveness does not amount to imbecility, but who require supervision and control for their own protection or for the protection of others and, in the case of children, who by reason of this mental defectiveness are incapable of receiving benefit by ordinary instruction in State schools, (iv.) morally defective persons, that is to say persons who display some permanent mental defect coupled with strong vicious or criminal propensities, over whom punishment has had little or no deterrent effect.

The *Act* proceeds after these definitions to say who are the responsible authorities and the first responsible authority is the parent or guardian. Every parent who has a defective child, is bound by law to provide him with

suitable care and education, but if by reason of not having sufficient funds he is unable to do so, then the Education authority steps in and takes charge of the child and is bound to act instead of the parent or guardian. A parent or guardian may place a defective child in an institution if he is under twenty-one, but he must produce two medical certificates and get the consent of the Board of Control. Once he has got the consent of the Board of Control and placed the child in an institution, he cannot get the child out without the consent of the Board of Control.

The second authority is the local education authority. They are bound to ascertain what children within their area between the ages of five and sixteen are mentally defective. This is a very easy thing for them to do, first, by means of their attendance officers, secondly, through the teachers who are well able to discriminate between the normal and the defective child, and thirdly, through the trained medical officers which each education authority employs.

There are four classes of children who have to be differentiated as follows: (i.) Those who can benefit by education in special classes in an ordinary school, (ii.) those who require special schools, (iii.) those who require institutional care, and (iv.) those who are ineducable.

When a child is found to be ineducable, he is handed over to the parish authority. It will be seen that the education authority is the pivot of the whole system. No defective can escape their net, for he is labelled and docketed when he commences school life and ever afterwards. No defective children ought theoretically to escape and their future care will depend on their symptoms, their financial circumstances and their surroundings.

The Parish Council.

In addition to taking care of children who are ineducable, and children who have reached the age of sixteen and who are defective, the parish council is bound to ascertain what persons within their area are defective within the meaning of the *Act* and these are persons who in addition to being defective are (i.) found wandering without visible means of support or are cruelly treated, (ii.) are guilty of any offence punishable by imprisonment or by being sent to a reformatory or industrial school, (iii.) are undergoing detention in prison or an inebriate reformatory, (iv.) are habitual drunkards, (v.) unmarried women who at the time of their pregnancy were in receipt of help from any local authority or (vi.) any person who has been three times or more often an inmate of a poor-house.

As to the commitment of these defectives, in the case where the parent refuses to act, the local authority can lodge a petition for the removal of the defective to an institution or to the care of a guardian. In the case of adults other than private patients the local authority petitions. The sheriff can order the defective before him and examine witnesses or he may appoint some person to examine the defective or he may visit the defective himself.

The commitment order only lasts for a year. At the end of that time the Board of Control on receipt of reports and a medical certificate renews the order for a second year and thereafter by similar process every three years.

This assures review of each patient's case at the end of the first and the second year and thereafter at the end of each period of three years.

No defective can be withdrawn from care without the consent of the Board of Control, but an appeal from the decision of the Board to the sheriff is possible.

With regard to the question of guardianship every person who is committed to care, may be committed to an institution or to the care of a guardian who may be a relative or a stranger. The guardian becomes responsible for the care of the defective. The houses of guardians are inspected at least eight times a year. Of course, the individuals placed under guardianship are carefully selected. It is found that patients are more contented under guardianship than they are in institutions and it is therefore desirable to make institutions partake as much as possible of the agricultural and industrial colony, to make them as domestic as possible, keeping in view the ideal of the life in the family and community which the defectives under guardianship have the privilege of enjoying and participating in.

THE PREVENTION OF FEEBLE-MINDEDNESS.

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DURING the last thirty years in England a quarter of a million persons have been discharged from asylums, many of them imperfectly cured. A large proportion of such persons propagate their species. Twelve thousand men and women are employed on the nursing staffs of the mental hospitals and the certified mental defectives in one hundred and seventy-two institutions cost nearly £7,000,000 *per annum*. Besides certified defectives there are in England over 100,000 feeble-minded and in addition again a percentage of the population (some say as high as 10%) is dull and backward mentally. Lastly there are the cases of neurasthenia and psycho-neurosis. All this constitutes a serious drain on the nation's capacity and much of it is preventable by careful watching and early treatment.

It was because of these facts that a conference was arranged last year by the Board of Control, visiting committees, medical superintendents and others to go into the question and if possible to suggest a remedy. The conference decided to ask the Government to introduce legislation permitting treatment without certification in institutions approved by the Board of Control.

This year *The Mental Treatment Bill* was passed through its readings and is now, I presume, on the statute book. In addition to providing for the admission and treatment of persons without certification, the Bill authorizes visiting committees to make provision for after care. Provision is also made for more systematic research. Lord Russell in supporting the bill said concerning the main purpose of the bill that a distinguished alienist had said to him: "Our treatment in lunacy is just about as sensible

as if we did not begin to treat a patient for scarlet fever until he was in the peeling stage." I regard it as significant that the bill is heartily approved by Professor Robertson, President of the Medico-Psychological Association of Great Britain and Ireland. He emphasizes the necessity of provision for the treatment of early cases without certification, as has been done with complete success in Scotland for the past sixty-six years under the original *Lunacy Act* of 1857.

At the Australasian Medical Congress of 1911 I strongly advocated the establishment of mental wards attached to general hospitals for the observation and treatment of persons in the incipient stages of insanity without certification, but on medical recommendation. Apart from the obvious clinical advantages of such wards over reception houses, I have always maintained that the latter institutions sooner or later come to be regarded as varieties of the lunatic asylum. Since reading that paper my views on this matter have expanded and perhaps slightly altered to the extent that I now regard the neurological and psychiatric clinic or as it is sometimes called the psychopathic hospital as the most scientific method of dealing with early cases. Neurology and psychiatry should be studied and practised together and not regarded as separate specialities.

America and Great Britain have attained a high degree of efficiency in psychiatric research and treatment in such institutions as the Boston Psychopathic Hospital and the Maudsley Hospital at Denmark Hill. In addition mention might be made of the outdoor clinic for nervous and mental patients established at the Radcliff Hospital, Oxford and the two wards recently opened at the Middlesex Hospital for the treatment of functional disorders of the nervous system. That we are progressing in the right direction in Australia is evidenced by the establishment of Broughton Hall, Sydney, where patients with incipient neurological and mental affections are received and treated without certification and by the out-patient psychiatric clinics at Sydney and Melbourne.

There can be no doubt that progress along the lines indicated above will eventually have a retarding influence on the spread of mental deficiency, but much more remains to be accomplished in the realm of public health. James V. May, in his book "*Mental Diseases: A Public Health Problem*," calls attention to the fact that there is another and an important side to public health other than that of physical well-being and the problems of hygienic environments and that is the mental efficiency of the people. He adds that the practical relationships of mental disease cover every aspect of human endeavor. Thus physicians, judges, magistrates, social and philanthropic workers, legislators and municipal governors, ministers of religion, educationalists, political economists, leaders of labour and others in the course of their ordinary professional, social and political activities have either to deal with the insane or with problems involving mental efficiency and inefficiency.

If this mighty problem is to be seriously tackled, the essential points to be considered are:

- (1) The detection of the feeble-minded,

- (2) Adequate control and segregation,
- (3) Care, management, and treatment.
- (4) Application of the principles of Eugenics.

Detection.

The facilities for detection appear to fall under four main headings: (i.) Systematic examination of school children by Government medical officers trained in such methods as those which have been evolved by Binet and Simon and by Professor Berry and Porteus; (ii.) the diagnosis and classification of all forms of mental defect amongst patients at Neurological and Psychiatric clinics; (iii.) the detection of cases of definite or apparent degrees of morosity and backwardness by special and general medical practitioners and the notification of such cases to a specified authority; (iv.) the detection and certification of cases of insanity in accordance with the provisions of our Lunacy Acts by practising physicians.

These methods would, I think, put us on the track of the large majority, if not all, of mentally defective persons, but if thoroughness is to be our aim, then they might be supplemented by such a measure as the routine mental examination of all immigrants.

Control and Segregation.

First of all I would announce the principle that the degree of control should correspond with the nature and degree of the ascertained defect. All degrees need control, but not all need segregation. In the minor or less serious forms of defect adequate control and supervision might be in the first place entrusted to those parents, relatives or guardians who realize their responsibility in this respect. At the same time the defectives might be kept in sight by a social organisation which would be in the department of or at least in touch with the above mentioned specified authority. For a sufficient reason such as inadequate control and supervision which might result in anti-social conduct of a dangerous or reprehensible character, the organization could have power to initiate steps for the segregation of the defective in question. I am not suggesting that these measures should be carried out without adequate safeguards for the liberty of the subject and such safeguards could be legally defined. It must also be remembered that even the sacred principle of "the liberty of the subject" may be exalted to an absurd degree, that the insistence upon it in certain cases may subsequently lead to evil results and that in any case it should be subordinated to the principles of eugenics and the social and mental purity of the race.

Parental or private control should be given a fair trial in the interests of both defective and parent or of defective and such guardian or friend as may correspond to parent. Much, of course, will depend upon the financial resources of the parent, guardian or friend and there can be no objection or danger in keeping a defective in a home environment which insures to the patient family affection, comfort, cleanliness, appropriate food, clothing, occupation and amusement and above all adequate control and supervision. This state of affairs actually obtains in very many cases.

It is often said in objection to segregation that hardships and cruelty are inflicted on both defective and parent. So far as aments as a class are concerned, they are quick to forget past environments and rather to ap-

preciate the conditions which mean for them regular feeding and congenial if primitive companionship. On the parents' side of the question there is more to answer, for not only must we give due consideration to parental affection, but we must recognize the fact that extraordinary affection is often lavished on the defective son or daughter. Where such affection is coordinated with adequate control and supervision, all is well as long as such a desirable state of affairs lasts. But when this fails, when the defective is cruelly treated or neglected or is allowed to roam at large to the danger of himself and others, then it is high time he were segregated both in his own interests and in those of the community. Further, segregation in such a person would be welcomed by all concerned. It is true that provisions in the Lunacy Acts of all countries provide for the segregation of many classes of mental defect, namely idiots, imbeciles and the various forms of acute and chronic insanity, but legislation is needed in some such way as I have indicated for that large class the members of which, though perhaps uncertifiable, are apt to drift into the paths of crime, drunkenness and prostitution and who as a result of their inefficiency hamper progress and swell the lists of undesirables and unemployed.

Segregation should be made more effective and exempt in certain special cases, more permanent by a revision and extension of the present system. At present there are homes for the feeble-minded, idiot asylums, epileptic colonies, mental hospitals and criminal mental hospitals. Gaols and inebriate institutions should perhaps be added to this list for chronic inebriates are mentally unstable and are frequently the progenitors of epileptics and other defective types both mental and moral, while of criminals it may be said that apart from the large percentage of ascertained mental subnormality amongst them, the problem of the differentialism between criminality and insanity is one which is ever present to our judges and expert mental witnesses.

Treatment.

Treatment includes educational training suited to the mental capabilities of the student and carried out by trained instructors in special schools, moral instruction and occupational training. In this way the mentally backward and to a large extent the moron may acquire some degree of erudition, may learn to realize his obligation to conform to the moral code and may learn to be to a large extent self-supporting and correspondingly less of a burden on the taxpayer.

The lower grades of amentia, namely idiots and imbeciles, will not benefit, except to a very small extent in the highest grade of imbecile, by educational, moral or occupational training. Notwithstanding these disabilities, however, their lives can be rendered more comfortable by the inculcation of good habits, a regular life, suitable environment and appropriate dietetic, hygienic and therapeutic measures.

We next come to the consideration of what should be the most humane and the most scientific methods consistent with reasonable economy of dealing with that large class above the aments, namely all the types of acute and chronic insanity. We have now to consider the old problem which has always been formidable and which only in recent years has shown a willingness to be solved.

Patients with acute and chronic affections are treated with excellent results, often under adverse conditions, in our mental hospitals. Unfortunately these hospitals are generally antiquated in structure and general outlay, overcrowded and understaffed by poorly remunerated medical officers. The best results can only be obtained by a maximum of individual attention given by keen and satisfied officers. Two things are essential, an increase in the medical staffs and the elevation of the status of asylum medical officers to a plane which should, at least, correspond to that of their professional brethren in general and special practice.

The methods adopted in various countries for the observation and treatment of doubtful and incipient cases of insanity are generally speaking as follows: (i.) Reception houses, (ii.) mental wards attached to general hospitals, (iii.) psychopathic hospitals such as those of Boston and Denmark Hill, (iv.) neurological and psychiatric clinics, usually in direct association with general hospitals.

Reference has already been made to the fact that reception houses come to be regarded as a variety of lunatic asylum. Even the highly scientific psychopathic hospital, for example, the Maudsley, is not entirely free from this disadvantage, a popular misconception of "stigma" which will only be obliterated by a more rational view of the nature of insanity. In spite of this disadvantage reception houses are doing excellent work, but in my opinion the greatest hope for the progress of psychiatry lies in the establishment of psychopathic hospitals and clinics, equipped with pathological and research laboratories. The Maudsley Hospital is most thoroughly equipped for all these requirements. It is reserved entirely for voluntary patients and no person is admitted under certificate or certified there either for retention or for transfer to a mental hospital.

After Care Associations and Convalescent Hospitals.

It is the experience of every alienist that much of the success which is accomplished in the treatment of acute insanity is discounted by insufficient convalescence, more especially when this takes place in fairly close association with acute and chronic cases. It is frequently seen that a stage is reached when the patient has lost his delusions and hallucinations, when memory, perception and other elements of mind have apparently become re-established, yet he is not sleeping well and he has not acquired normal adjustability between thought and action. Such a patient will fret at being further detained in an environment which he believes to be unsuitable, his friends request his discharge and he is discharged before the mental balance has been completely re-established. A few weeks convalescence in pleasant surroundings under skilled nursing attention and above all away from the harmful vicinity of acute and chronic cases is necessary to fit the patient for that contact with the outside world amidst the environments of which his illness was contracted.

To overcome the defect in this direction there might well be instituted in every lunacy department, convalescent hospitals and mental after-care associations.

Application of the Principles of Eugenics.

This subject is surrounded by more difficulties and dangers than any other in the whole catalogue of mental

hygiene. Briefly stated the science of eugenics has for its aim the propagation and preservation of the fit and the elimination of the unfit. We take great care of the unfit. Even the most degraded idiots and the most vegetative demented not only receive more care and attention from a dietetic, hygienic and therapeutic point of view, than self-supporting and useful members of the community, but in the event of their death in an institution, something more detailed and explicit than the ordinary medical certificate must be furnished to the satisfaction of the coroner. It is understood of course that humanitarian ideals underlie our systems of dealing with the unfit, but it has even been argued that in the ultimate interests of the race the procedures should be reversed, that the fit and the useful should receive all our care and consideration and the unfit be left to the fate which would overtake them as a result of the free operation of Nature's law of the survival of the fittest. Even the lethal chamber has been advocated, perhaps not openly, for all types of incurable mental defect. It is not, however, by an advocacy of extreme views that we shall attain to the best course, that which, while reasonably humane, will eventually tend to the eugenic ideal of a race mentally sound.

Eugenic principles are carried out in many ways and embrace all those legislative and municipal measures which aim at good housing and drainage, better conditions of labour, pure food regulations, general hygiene, the abolition of dangerous drug habits and increased facilities for early and efficient medical and surgical treatment to those in need of them.

So far as the criminally degenerate and mentally defective are concerned, we need only consider: (i.) control and supervision, (ii.) segregation and (iii.) prevention of propagation.

Control, supervision and segregation to a large extent, but by no means wholly, insures the prevention of propagation. Even under the strictest provisions of an Act for enforcing the segregation of all forms of mental defect, there would still remain a considerable number of defectives who continued to propagate their kind. Under our present lunacy laws the provisions of which have come in for much adverse criticism because of their alleged tyrannical control of the subject's liberty, male and female patients, admittedly unstable, are discharged from asylums as being no longer insane. Many of these persons eventually have to be re-certified, but in the meantime they have been at full liberty to propagate their species and so the vicious circles continued. To cope with this undesirable situation, we must perforce consider three expedients: Permanent control or segregation, sterilization, the production of a good bill of health at marriage.

I have already spoken of control and segregation. Over the question of sterilization violent controversies have taken place and it seems likely that even if such an advanced eugenic idea were put into practice, it would apply only to the gross forms of criminality and mental defect. It would, therefore, serve only in a partial degree the object for which it was intended. It would appear that the time has not yet arrived when the people would sanction legislation which had for its object the sterilization of the unfit.

There remains the health certificate at marriage. When we realize the magnitude of the harvest which is being continually reaped as the result of marriages where one or other of the contracting parties is affected by syphilis or mental instability, we are faced with a graver problem than the segregation and treatment of mental defectives. Surgeons, physicians and specialists of every kind can speak in definite terms of the ravages caused by acquired and congenital syphilis, while every alienist has to deal with men, women and children who began life handicapped by neuropathic inheritance and such persons constitute at least 80% of our asylum populations.

I therefore make no apology for advocating legislation which will have for its object the prohibition of marriage in cases where such union would be likely to produce dire results in the inoffending offspring. If the provisions of a pure marriage act were made to apply in the first place only to those obviously affected persons about whom there could be no question, the details of its application in practice might well be a matter for consideration by some carefully selected committee or association, such for example as the body recently constituted in England, The National Council of Mental Hygiene.

In America the National Committee of Mental Hygiene works harmoniously with the superintendents of mental

hospitals and with the Medico-Psychological Association. It concerns itself with the treatment of incipient mental disorders, mental deficiency and social questions generally. It has local branches in every State and the officers attached to these branches are establishing out-patient clinics for the treatment of incipient mental disorders. In England the newly formed National Council of Mental Hygiene is endeavouring to coordinate its activities with those of the Medico-Psychological Association, but as the conditions of lunacy administration in England differ from those in America, we have yet to learn what the exact functions and limitations of the Council will be.

An association of this kind in Australia, working in affiliation with the lunacy departments should have a wide scope for its activities. It might concern itself with the establishment of neurological and psychiatric clinics in association with general hospitals, the promotion of research, the establishment of after-care associations, social visiting committees, a mental section of public health, the planting in the public mind of a more rational view of the nature, causes and prevention of mental degeneracy by means of popular lectures on mental hygiene and generally speaking by these and other measures which may commend themselves from time to time, thus to stimulate public interest and sympathy in this nationally important subject.